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FUEL ECONOMY.

BY FRANK C. SMITH.

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ONE of the largest fields for the reduction of expenses on a road is in the coal consumed by the engines. This item alone is from 11 to 15 per cent. of the total expenses of a road dependent on the accessibility of coal mines, and the care and manner with which coal is used. It is the practice of too many roads to allow all record pertaining to the coal account to disappear after it is purchased and delivered to the locomotive department, where too often engineers take much or little, use it carefully or wastefully, as they see fit. It has been well said that a road might as well furnish each engineer with money to buy his coal with, and keep no individual account of the money but make one grand charge of it to "coal account," as to follow the practice so many of them do.

A great many roads store their coal on docks, fitted with cranes for lifting half-ton buckets for delivery to engines, the engineers giving a check for the amount of coal received, and so far as this is concerned no fault can be found. But the fault commences in keeping account of the coal, and in the abuses of the premium system. Where roads pay the engineer a premium—generally half the value of the coal he saves over a given limit per car mile—it is too frequently the case that engineers bribe the dockmen with a quarter of a dollar to put an extra ton on their tenders, which, as an investment, is profitable to the engineer, since if coal be worth, say, two dollars per ton, the engineer gets credit for saving a ton, which means one dollar, less what he gives as a bribe to the dockmen, and this is clear gain to the engineer. Such "rings" as this are much more common than is believed, inasmuch as the dockmen are the cheapest class of laborers whose only duty is to shovel coal and receive the checks for it, and a small bribe makes a very effective lever with them. As the coal account is never balanced, that is, the amount of coal left on the dock weighed at stated times and added to the amount charged out to the engines, to ascertain if it tallies with the amount dumped on the dock from the cars, no trace of the extra tons surreptitiously given out is to be found.

Injustice, unintentionally, is done the engineers, where their record for premiums or good standing is based on the number of cars hauled a given distance for a given amount of coal, from the fact that few roads have a correct rating for the real amount of coal consumed in hauling mixed trains of light and loaded cars. That is, one road may *guess* that two light cars are equal to one loaded car; another, that five light cars equal three loaded cars; another, that seven light cars equal three or four loaded cars. As this is all guess-work, the engineer who happens to haul trains in which the error, which ever way it may be, of this guess predominates, suffers. However, it is said, that this is as fair for one engineer as another, and possibly it is, but it is evident that the injustice still remains.

In this connection may be mentioned the fact that few or no roads separate the coal consumed into engine and car miles. That is, the engine itself requires a certain amount of coal to propel it, and unless this amount is known and separated from the car miles, it all goes in to swell the amount consumed per car mile. Now it is clear that as this amount remains constant, the amount per car will be greater as the number of cars are less, and less as the number of cars are increased, so that when business is good on the road the engineer apparently is burning less coal per car mile, and when business is light the showing is against him.

To get at anything like a fair and equitable arrangement as well as a profitable one for the road, the coal business should commence from the bottom. A road in buying coal should test it practically by taking a train with engine, loading the tender with a known amount of a certain kind of coal, running the train under conditions of speed, stops, etc., which are recorded, and ascertain how far or how much coal is consumed per car mile; then with the same train and engine under the same conditions test another kind of coal, and in this way ascertain which is the cheapest coal to use.

The coal business down to the time it is delivered to the engines, might well be placed in the hands of a coal agent, who is independent of the locomotive department, in order that the results may be disinterested, as many master mechanics have a prejudice for or against engines of their own or other builds, and such prejudices are apt to shade the results of their performance. By this means the relative value of different types of engines may be determined, and the bad record of a "pet" engine or class of engines brought to the surface.

Some system which keeps a constant pressure on each engineer to do better should be adopted. The premium system acts upon an engineer's avarice and appears to give the best results; another system—that of "blacklisting" or posting up in the roundhouse the names of engineers who burn over a given limit of coal—is supposed to act on the engineer's pride, while the system of suspending an engineer who exceeds the limit for two or more consecutive months, acts on his fear and indirectly his avarice, as it stops his pay for the time being.

In order to get a proper rating, the fuel consumed to run the engine *alone* should be ascertained, and then the amount to haul a loaded and a light car. This can be easily ascertained, and by so doing the exact amount per car, whether loaded or light, and independent of the amount to propel the engine can be charged against the

engine. This should be ascertained for Winter and Summer, as it is plain that the amount will increase in Winter, when the losses from radiation of heat, slipping of engine, and greater friction of car-journals from stiffened oil will require more power and consequently more fuel.

It will be charged by practical men that such a system would involve a great deal of clerical labor, which is not true, as the practical man for want of experience in the keeping of accounts is afraid of them and exaggerates the matter. Any road with officials at the head of its locomotive department who understand the importance of the saving which can be effected by a proper course in the matter, can, by changing their present plan to one based on this system, effect the result with no increase of clerical work, for the plan is not more complicated than many unsatisfactory ones in use, and it does not involve complication or increase of labor, but simply a correct systemization of accounts, and it would therefore in many cases decrease the clerical labor and in no case augment it. The saving which may be expected to result will vary from 10 to 15 per cent. As an example of this, the wriier may cite a case in his personal knowledge in which seven passenger engines of the same build, size, and condition are pulling indiscriminately—that is, "first in first out"—the through passenger-trains of a certain road. Two of these engines average five tons of coal for a round trip while the other five use from that amount up to nine tons. The difference is not in the engines but in the men, for either of the two men using five tons have done the same with each of the other five engines, and the two engineers using but five tons admit they could save from one-half to three-quarters of a ton if they tried hard to do so. This road has no system at all for reducing the coal consumption, and the want of it is seen from this statement. As the road refered to is a large road of several divisions these results may be taken as a sample of what the rest of the engines are doing. The road has some three hundred engineers, and taking the performance of these seven engines as a standard, it will be seen that they average about three tons of coal each unnecessarily burned per day, for a service of three hundred days per year. The result is astonishing, since the coal is worth $2.00 per ton on the tender and the product of the whole gives $540,000 as the value of the coal *unnecessarily burned.* But even if this estimate be five times too large, the waste still amounts to over $100,000 per year; a sum any road might well save. It is, perhaps, unnecessary to add that the road refered to is in the hands of a receiver.

FREE-TRADE IN RAILWAY TICKETS.

BY S. S. HERRICK.

[Written for the AMERICAN RAILROAD JOURNAL.]

THE writer is neither a railway official nor a ticket-broker, and therefore not a partisan in the bitter strife now and sometime waging between these parties. His position is that of an interested spectator, desirous of seeing fair play, without damage to the real interest of either the public or the railway companies. Though this controversy notably affects the convenience and the pocket of the traveling public, they have made no public demonstration of concern. It is obvious that the scalper has the approval, if not the sympathy, of the great majority, from the liberal patronage which is accorded him; and equally so that, though numerically the weaker party, he is almost uniformly the successful one. Such is likely to be the result to the end of the chapter, and so it might be superficially supposed it ought to be, on the ground that the just cause is sure to win; but it is better to examine below the surface of the subject.

The controversy has reference to coupon and round-trip-tickets. The reduced price is an inducement for increased travel and no doubt this more than compensates for diminution in rates; but it is required that no one but the original purchaser of the ticket shall have the privilege of using it. If it could be alleged that this condition is imposed in order to keep objectionable persons from the trains, the reason might be a good one; but no discrimination is made at the time and place of purchase, and no one pretends to account for the restriction in this way. The object is simply to prevent the traveler from obtaining passage from one point to another at less than the local rate, unless he alone is to complete the journey within a limited time. If anyone else can manage to travel on the ticket, both will be sure to avail themselves of a practicable chance to save money, and this saving the official regards as so mnch loss to his company. It is well to see whether this supposition be correct.

Every reduction in railway rates is made with the view of increasing patronage to a degree more than compensatory. Curtailment of the offer by conditions which throw difficulties and uncertainties in the way certainly detract from the inducement to travel, and so far counteract the advantages to the public and the company. As a mathematical certainty in the present case, the actual saving to the public in individual rates and the aggregate gains of the companies depend largely upon the notorious success of travelers and scalpers in circumventing railway officials. Suppose failure to be the rule, is it not clear that many would stay at home who now travel?

What then is the result of all this controversy? Simply annoyance to travelers, and cultivation of a spirit of resentment and determination to "beat" the railway at every opportunity. If the conflict were confined to the companies on the one side and the scalpers on the other the issue might be different; but the latter have the great public for allies and do a thriving business.

Suppose now, that one of a number of competing lines should be liberal enough to abolish all these silly restrictions and annoyances; could there be any doubt that it would speedily gain a largely increased patronage at the expense of its rivals? And when all had abandoned this narrow policy, the public would rejoice in the removal of detested obstacles, the companies would find their business increased and nobody would be the loser.

It is apparent that people will purchase and use articles quite in the same ratio with which they can transfer them to others. Why not put railway tickets on the same footing as bank-checks, notes and drafts? Let anybody use them, and they would be bought more freely, in full confidence that they can be enjoyed without risk or hindrance. The same reasoning might apply to a time-limit on tickets but this point is not now discussed.

There is besides an ethical feature in the case, which is of serious consequence. People are influenced by prospect of pecuniary advantage to practice deception on railway companies and, in fact, have less scruple in doing

so than in dealings with other parties, from habit as well as resentment. As a matter of simple expediency, therefore, companies should avoid any policy which encourages such practices.

Hence the conclusion that rules restricting the transfer of railway tickets are injurious to the companies, for the following reasons: 1. They provoke strife, with constant discomfiture to their contrivers. 2. The practice of deception is inculcated and is liable to extend to all transactions with railway companies. 3. Business is damaged in direct ratio to the difficulties imposed upon those who seek transportation facilities.

Good policy and good morals always agree. When people ask bread, it is bad policy to give them a stone.

AMERICAN AND ENGLISH LOCOMOTIVES.

BY A MASTER MECHANIC.

[Written for the AMERICAN RAILROAD JOURNAL.]

IT is questionable if anything American has been so much misrepresented by the English, and especially the English mechanical paper *The Engineer*, as American locomotives. Whether this is the result of blind prejudice which will not admit the truth, or a want of information as to the facts, is hard to decide, although it will not be far from the mark, probably, to set it down as a fair admixture of both. The general charge is that American locomotives burn from fifty to one hundred per cent. more fuel to perform the same work that English engines do. This charge is loosely made with no attention whatever to the number of tons hauled by our engines.

The writer met an English engineer or "driver" a short time since who is now running an engine in this country, and in a conversation on the comparative merits of American and English engines, the engineer handed the writer a performance slip that he had brought over from England. This slip shows that engine No. 2,280 in the month of September, 1881, ran 2,017 miles and consumed 35 pounds of coal per mile. The train consisted of six coaches and a baggage-van and guards-van, or eight cars. The coaches seated 50 passengers each, were 30 feet long and weighed about 7 tons, 18 cwt., or say 8 tons. The brake or guards-van weighed about 7 tons, 10 cwt., or in round numbers the train consisted of eight cars weighing 8 tons each. As the English ton is 2,240 pounds, the 8 tons per car makes each weigh a little less than 9 of our tons. This would give for the eight cars, 72 tons. If the six coaches were full of passengers they would hold 300 people, and, assuming each passenger to weigh 150 pounds, this would add 22½ tons, or a total of 94½, or say 95 tons. If we now divide the weight of the train in tons into the consumption per mile it will give us a measure of economy with which we can compare American practice; $\frac{35}{95} = .368$ or $\frac{368}{1000}$ of a pound of coal per ton per mile.

Meeting an acquaintance a few days since who is running a passenger-engine on a large road in Ohio, I asked him if he could give me a performance slip of what his engine was doing. He handed me the last one he had received. This slip shows that engine 158 made 6,200 miles in June, 1885, that the engine burned 45.45 pounds of coal per mile, and hauled an average train of a trifle over five cars per train. These trains consist of three passenger-cars weighing 25 tons each and two baggage-cars weighing 18 tons each, or a total of 111 tons. The passenger-cars seat 66 persons, or a total of 198, who, at 150 pounds each, would weigh nearly 15 tons, which added to the weight of the train, makes a total of 126 tons. Dividing the consumption of coal per mile (45.45 pounds) by the weight of the train in tons, we have $\frac{45.45}{126} = .362$ or $\frac{362}{1000}$ of a pound of coal per ton per mile or $\frac{6}{1000}$ of a pound *less* than the English engine is doing. In place of the loose and incorrect assertions of *The Engineer*, which have always been to the effect that American engines were burning 100 per cent. more coal than English engines, we find, that undoctored facts show that the American engine is the most economical. *The Engineer* has frequently asserted that English engines are burning but 22 pounds of coal per mile. On asking for information on this point from the English driver he replied that it could only be done with a very light train, and as an English train is very light as compared with an American train, a very light English train must be light indeed—somewhere about 50 tons—and probably compares with an accommodation-train on an Ohio road that the writer has in mind, which has shown a consumption of but 20 pounds per mile.

The Engineer has gone so far in its blind prejudices as to assert that the American Master Mechanics' Association stated that the consumption of coal by American engines was "from 50 to 100 per cent. in excess of that required by English engines." The facts are that the Association never made such a statement, for want of knowledge of what English engines are doing. This statement grew out of a suggestion by a member or committee that it would be interesting to get an English engine and try her on our roads, in order to find out how she compared with American engines. Such loose and inaccurate statements have done much to place the value of *The Engineer* at a very low rate in this country.

In all English colonies the American engine is prefered to the English engine, although it meets with opposition frequently of a questionable character. A characteristic incident occured on an Australian road—the Adelaide and Nairne Railway—a few years back. In 1880 a prominent American locomotive-building establishment built four engines for this road. These engines had cylinders of 19 x 24 inches with driving-wheels of 60 inches diameter. These engines are capable of exerting a pull on the draw-bar of $(19^2 \times 24 \times 100) \div 60 = 14{,}440$ pounds which would allow of the engine (disregarding her friction) hauling at a slow speed, 2,880 tons on a level. Notwithstanding this, this engine was allowed to stall with *98 tons*. The real cause of this was first, that the engine was American and the locomotive superintendent of the road was an Englishman. The engine had made six miles when she stopped because her grate-bars burned out. In this country the burning out of a new set of grate-bars is considered an equivalent to the incapacity on the part of the engineer in "burning" the engine, that is, allowing the water to get so low as to scorch the crown-sheet. An investigation by the builders of the engine developed the facts that the engine was taken out and coupled to the train with her ash-pan *solid* with cinders from her previous trip. Through intentional neglect the ash-pan was not cleaned out; and as no air could enter the ash-pan or find access to the under side of the grates, they very naturally

melted out, and on account of this piece of vandalism the locomotive superintendent reported the engine as a failure. The locomotive superitendent's report was that the engine stalled with 98 tons, although she was capable of hauling 2,880 tons. It is a well-known fact that English cars pull much heavier than American, as will be shown further on, but even if every car in the train had solid blocks of iron to slide on in place of wheels, the engine would have hauled them, had she not have been subjected to the most outrageous treatment. The writer was informed by an English railway official who had traveled extensively in this country, that he found English engineers, etc., much less intelligent than American. He said the want of success which the Westinghouse brake experienced in England, when first introduced, was due entirely to a want of intelligence on the part of the engineers and others who had the matter in charge. The cost of an American engine in Australia is £2,700, while an English engine costs but £2,000. But the report of the chief engineer of this road shows that the American engine is capable, and does perform twice the amount of work of an English engine, so that £2,700 worth of American engines is equal to £4,000 worth of English engines. From the same report it appears that in January of that year, the American engine ran 2,781 miles, burning 54 pounds of coal per mile, or a cost of hauling 100 tons one mile, of 1.86 pence. Owing to the prejudice against this engine it is probable that she really performed 100 per cent. better. The same report shows that the cost for hauling 100 tons one mile by the English engines was 2.73 pence, or making proper allowance for prejudice, 3.73 pence. The total cost per 100 tons hauled one mile, including engineers pay, etc., was 2.56 pence for the American engine, while for the English engines, this total cost is given at 4.33 pence. With proper allowance for prejudice and ill-treatment of American engines it will be close to the mark to say that the American engine was better by from 150 to 200 per cent.

The improvement in economy which would follow the use of American cars on English colonial roads is shown by the fact that in "Colburn's Locomotive Engineering" (an English publication treating of English engines and cars), is found the following formula for ascertaining the resistance per ton, where R is the resistance and v the velocity; $R = 12 + (v^2 \div 114)$. This gives for a speed of 50 miles per hour, a resistance of 34 pounds per ton. Prof. Dudley found with his dynagraph-car that American trains of 300 tons and upward at 50 miles per hour gave a resistance of but 10 to 11 pounds per car. Applying these figures to an English train of 400 tons at 50 miles per hour, (4,400 feet per minute) we have $400 \times 34 = 13{,}600$ pounds and $(13{,}600 \times 4{,}400) \div 33{,}000 = 1{,}813\frac{1}{3}$ horse-power as necessary to haul the English train. The American train requiring but 10 pounds per ton would require $400 \times 10 = 4{,}000$, and $(4{,}000 \times 4{,}400) \div 33{,}000 = 533\frac{1}{3}$ horse-power, to which may be added, on an allowance of 20 pounds per ton of engine, if it weigh with tender 70 tons, $70 \times 20 = 1{,}400$, and $(1{,}400 \times 4{,}400) \div 33{,}000 = 186\frac{2}{3}$ horse-power, or a total of 720 horse-power as compared with $1{,}813\frac{1}{3}$ horse-power for the English train. In view of these facts it would appear that *The Engineer* would do well to investigate the value of American engines and cars on their merits, and give its readers some reliable information devoid of prejudice.

RAILS AND TRACK LABOR.

THERE is a feeling among not a few American trackmen, which for the time being has almost as much force as if it were an undeniable thing, that a 60-lb. rail is about the dividing line between light and heavy rails for fairly heavy traffic, that a 65-lb. is something good enough for any one, and that to use a 70 or 80-lb. rail is something like wasteful extravagance on any but roads of the very heaviest traffic. In fact, it has recently been contended with some authority that there is no economy at all, but rather a disavantage, in using heavier rails than 60 or 65 lbs.; that only a certain fixed amount, say $\frac{3}{8}$ to $\frac{7}{8}$ inch can be worn off the top of any rail without so destroying its surface as to make it worthless for good track, and that for this and other reasons buying anything more than a 65-lb. rail is a waste of money which might better be devoted to track labor for maintenance of surface. It is even contended that heavier rails make the track too rigid.

That there is great force in one of these arguments at least, if its truth be admitted, is clear. If rails tend to wear so rough that they will only stand a certain fixed amount of wear before becoming worthless for this cause alone, the futility of increasing the section to obtain longer wear is evident, and it would hardly be asserted that the greater stiffness and strength alone of the heavier section would justify its greater cost. So, too, if rails are to batter down at the joints within a few months after laying, as some poor rails do, so as to need removal for that cause alone before they have sustained any considerable wear, extra money for extra weight of section is plainly wasted. But neither of these causes of failure will be generally admitted to be other than exceptional. Even fairly good rails do not batter at the joints, nor do they wear rough, to such an extent as to cut short their life much below that due to normal wear, under ordinary circumstances.

Barring these causes, and neglecting as trivial the objection that any practicable rail can make track "too rigid," there remains only this question: Where is money for improving track best expended, in increasing the rail-section or in more track labor?—and there are certain considerations which seem to indicate quite strongly that this question has not been always considered with sufficient independence and care, and that the worst sins against sound economy are committed, not by those who buy 30 or 40 or 50-lb. rails for poor thin-traffic roads, but by those who buy 60 or even 65-lb. rails for prosperous and busy roads, with the idea that they are thereby taking the most economical course to obtain a first-class track. First-class track, it is true, can be and is obtained with such rails, but whether saving 5 to 10 lbs. per yard on such heavy rails does not waste more money than it saves and more than proportionate savings on lighter rails and for poorer roads, is another question.

That there is an immense gain in strength, stiffness and durability in increasing the weight of even the heavier rails we have already seen in a recent issue, but as the discussion referred to seemed to be directed, even more than it really was, to distinctively light rails of less than 50 lbs. per yard section, we may repeat the conclusions there reached in respect to the sections without now giv-

ing the grounds for them. According to the conclusions there reached:

	Increases			
Adding to a 60-lb. rail	Weight.	Stiffness.	Strength.	Durability.
10 lbs. per yard..........	16.7 p. c.	36 p. c.	26 p. c.	83 p. c.
20 " " "	33.3 "	79 "	54 "	167 "

the weight varying directly with the section, the stiffness as the square of the weight per yard, the strength as the 3-2 power, or square-root of the cube of the weight, and the durability being determined by assuming (1) that about half the weight of any section is in the head, (2) that with rails very light for their duty only ¼ of the head can be worn away before the rail becomes unserviceable, and (3) that a heavier rail may at least be worn down until the head is no heavier than that of the lighter rail when unserviceable.

That the three qualities which are desirable in a rail, strength, stiffness and durability, are much more cheaply purchased in the heavy sections than in the lighter sections, is clear enough from this statement. It will be seen that the additional stiffness gained costs less than half as much, the additional strength but little more than half as much, and the additional durability only one-fifth as much, and we need hardly repeat that, inasmuch as the function of the rail is not only to support the load from tie to tie, but to relieve the strain at joints and the load on low or imperfectly bedded ties, there is always use for all the strength and stiffness there is in an ordinary rail-section. The stiffer the rail the less perfect need be the supports of the road-bed for equal excellence. The only question is whether this needed support cannot be more cheaply obtained by putting a little more work into the surfacing.

Strenuously as this view is maintained by some entitled to a hearing, it hardly needs more than to present a few contrasting figures strongly to indicate, at least, that it is more an impression than a well-founded belief.

To increase the weight of rail 10 lbs. per yard requires, in round numbers, 16 tons per mile, costing, at the even figure of $30 per ton, $480 per mile, the interest on which is:

At 5 per cent.	At 10 per cent.	At 20 per cent.
$24.00.	$48.00.	$96.00.

Equal to a cost *in cents per train mile*, assuming various numbers of trains per day each way, of—

	Cents per train mile		
	At 5 p. c.	10 p. c.	20 p. c.
1 train per day....................	3.29	6.58	13.16
2 " "	1.64	3.29	6.58
10 " "	0.33	0.66	1.32
20 " "	0.16	0.33	0.66

It would seem as if no demonstration were needed beyond this table to show that on a road of any considerable traffic, the stability gained by adding 10 lbs. per yard to the weight of a 60-lb. rail would give far more for the money invested, at any probable rate of interest, than the expenditure of an equivalent sum annually on additional track labor for lining and surfacing. On a road running 20 trains per day, even if it cannot get money at less than 10 per cent., the interest charge of $48 per year per mile amounts to but 0.33 cent per train-mile, whereas the common expenditure on raising and surfacing, ballast, etc., is about 10 cents per train-mile. Therefore the extra 5 lbs. per yard has only to save less than 3⅓ per cent. of track labor to be a paying investment. It seems probable at once that more than that might be saved, and yet maintain equal condition even when the rail was a tolerably heavy one.

It will make the justice of this conclusion clearer to consider for a moment the opposite extreme of light-traffic roads. As respects such roads, especially those built at great cost for capital, the case is not so clear. In fact, for the extremes of their traffic and scant capital, say one train per day and 20 per cent. cost of capital, it seems almost clear that it will not pay to increase the rail beyond what safety requires, as the cost of interest on even 5 lbs. per yard extra weight of rail will in that case be 6.58 cents per train-mile.

But, premising that this extreme case can but rarely be approached in practice, because (1) there are few even of the lighest traffic roads which do not run more than one train each way per day, and (2) few roads are so poor that, if the case is properly presented, they cannot raise a moderate additional capital for betterments which, whatever the profit on the enterprise as a whole, will return 20 per cent. profit on their own individual cost; it may be questioned, from the results of experience, whether even in this extreme case the extra weight of rail is not the best use which can be made of the money. The very least which can possibly be spent on mere track-surfacing and maintenance, and keep it in fairly safe condition for the passage of one train per day, is from $100 to $125 per mile, with $80 to $100 additional for ties, or say $200 in all, excluding perhaps $100 more for yards and miscellaneous. The cost of the 5 lbs. per yard extra weight, even at 20 per cent. interest on capital, is only $48 per year, for which slight increase of one-fifth or one-sixth in the interest charge on rails we obtain an average increase, in a very light rail, of fully 50 per cent. in the three elements of strength, stiffness and durability. Granting a road to be so poor that no increase whatever in total charges can be borne for any betterment beyond absolute necessities, however great, is it certain that so great a difference in the stability of the rail will not enable one-fourth of the otherwise minimum track expenditure to be saved, while yet leaving the track as safe and good as before? It is a fairly even balance, indeed, under this extreme supposition; unless the rails were very light indeed it probably would not pay to increase it; but it is difficult to escape from the conclusion that under any ordinary conditions of traffic it plainly will pay to use a tolerably heavy rail before relying on track labor to make up by better surfacing for its deficiency of strength, simply to save a slight additional investment of capital; and if so, as the traffic increases up to a comfortable average, as to 6 or 8 or 10 trains each way per day, there becomes an immense economy in using heavy rails to save track labor, so much so as to indicate strongly that the very curious similarity in weight of rails used on all roads in this country above the poorest class, despite the great differences in volume of traffic, is due, not so much to the use of too heavy rails on our light-traffic roads as to the use of far too light rails for true economy on our more important lines, as for instance 60 or 65 lb. rails on trunk lines which would be acting more wisely to use 70 or 80 lb. rails. The difference is, however, that such lines are rich enough to stand the resulting loss, whereas a poor road which permits its poverty to destroy it by buying an over-light rail, cannot. Some of our more prosperous lines have recently begun to break through this rule by using what are now called very heavy rails, but the exceptions are not yet so numerous as to do more than prove the rule.

There is an apparent objection to this line of argument; that it assumes the cost of track labor to be very nearly so much per *train-mile* instead of per mile of road whereas in fact, it is often stated, it does or ought to vary more nearly with the distance than with the traffic, so that whether there are twenty or thirty or forty trains per day passing over track, it must be in about the same condition, and hence must cost about the same sum per mile to maintain. From this it must follow that it is not fair to divide up the interest charge on extra weight of rail among a large number of trains, and thus reduce it to trifling proportions, while assuming a nearly fixed cost *per train* for lining and surfacing.

The answer to this objection is that we can only base action on the facts which appear. Perhaps the maintenance charges ought to vary more nearly with distance than with traffic, but as a matter of fact they do not. This interesting and important fact we cannot now attempt to establish, but as it is both interesting and important we shall do so in a following number.—*Railroad Gazette*,

GENESIS OF A CAR-WHEEL.

It is estimated that there are ten million car-wheels whirling over this country at the present moment, conveying millions of passengers and more millions of tons of freight to and fro across the continent at an average speed of 25 miles an hour for passengers, and often 40 miles. How many of the hurrying multitude who trust their lives on the rail, pause to consider the admirable mechanism by which these great results are accomplished? How many complex problems have been solved in the gradual evolution of the old-time stage-coach into the modern iron horse and his train?

Take, for example, a car-wheel, one of the simplest parts of a railway-train; it is merely a round piece of iron, and, as we generally see it, covered with dirt and grease, having nothing attractive or ornamental in its appearance, and seemingly gross in its construction; yet that smaller and more valuable disk, known as "Uncle Sam's" double-eagle, which issues from the mint, glittering like a mirror, does not involve in its manufacture more intricate and, in some respects, more delicate manipulation than this same gross car-wheel.

The most important difference between a car-wheel and any ordinary machine or apparatus made of cast-iron, is the fact that the "tread" of the wheel, viz., that part which runs on the rail, is quite different in character from the "plate" or main body, though cast from the same metal in one pouring. The tread or rim is actually harder than the finest steel, thus enabling it to resist not only the wear upon the steel rail, but the still more destructive grip of the brakes; and its average "life" is not far from 100,000 miles of service. The process by which the hardening of the tread is produced is called "chilling," and is somewhat analagous to the "tempering" of steel. A mould is made in sand from a wooden pattern, the moist sand is pressed by the moulder against both sides of the pattern with a hand rammer, and it is then sufficiently tenacious to enable the pattern to be carefully removed without destroying the mould. This "sand mould" is enclosed in a ring made of iron called the "chill mould," whose internal face has been previously turned upon a lathe to form the tread and flange of the wheel, and numerous air-passages, or vents, are made through the sand with a long needle to permit the gentle escape of highly explosive gases which are formed when the molten iron is running into the mould. The stream of glowing fluid-iron quickly fills the hollow space between the upper and lower sides of the sand mould, and running to the edge comes in contact with the iron ring, or chill mould, and this being a much better conductor of heat than the sand mould, chills the rim of the casting, not only congealing the iron instantly, but causing it to crystallize to a depth of about half an inch in beautiful parallel filaments, as white as silver and nearly as hard as diamond. The portion of the wheel forming the plate or sides cools more slowly, is not "chilled," and its texture is the same as that of ordinary cast iron. If the wheel is made of a mixture of iron which is too highly sentitive to the chilling influence, it will be too brittle for safety and too hard to permit of boring the hole in the hub into which the axle is to be fitted. If, on the other hand, the metal does not possess sufficient chilling property, the tread of the wheel is too soft and soon becomes flattened, and then the wheel is useless. The margin between these extremes is very small, and it is the daily aim of the wheel-maker to steer between this Scylla and Charybdis.

It must not be supposed that all irons posses this chilling property, for it is a comparatively rare one, and little is known, even among the most expert iron masters, of the causes which produce it. Very recently some light has been thrown upon the subject by the aid of chemical anaylsis, and scientific investigation will doubtless reveal still more clearly what is as yet but dimly seen. Pig-iron is not a simple substance, but is in reality an alloy composed of at least half-a-dozen different elements, each one of which helps to stamp its character upon the metal. It has been found, for example, that the substance silicon, which is always present in pig-iron, exerts an extraordinary influence upon its chilling power, and a variation of less than 1 per cent. of silicon is sufficient to make or mar a car-wheel; indeed, it has happened that an entire day's work of several hundred men has been spoiled by an excess of one-half of 1 per cent. of this substance creeping undetected into the mixture. The method of analyzing the iron to ascertain the proportion of carbon, phosphorus, manganese, sulphur and silicon which it contains is too complicated to admit of a general description; suffice it to say, that a few grains of a sample are reduced to fine powder, weighed upon an extremely sensitive balance, treated with acids and other "re-agents," or tests, by which means each element is separated from its partners, and its weight ascertained. In a wheel-foundry the iron is commonly melted in a large furnace called a cupola, capable of melting fifty or more tons a day. Anthracite coal is used, and a strong blast of air from a pumping-engine creates an intense heat. As the iron melts, it collects in a pool at the bottom of the furnace, from which it is drawn into an immense ladle or cauldron, sometimes holding fifteen or twenty tons; from this it flows into smaller ladles, holding just sufficient molten iron to make one large wheel.

Great skill is required in pouring the iron into the mould. It must be just the right temperature and it must be allowed to run into the mould with just the right force; otherwise a bad casting is the inevitable result.

After the wheels are taken out from the moulds, they require to be thoroughly annealed as they are subjected to an immense strain due to the more rapid cooling of the chilled tread. For this purpose they are either put into pits previously heated, or buried in hot sand, where they are allowed to remain for several days. In this way the molecules of the metal gradually arrange themselves in new positions and the strain is entirely removed. The sand which adheres to the wheel is then brushed off, and the wheel tested for strength by heavy blows with a sledge-hammer, and for hardness on the tread by chipping with a highly-tempered cold-chisel; in this way any "soft spots" may be readily detected and the wheel accordingly condemned. There are, in fact, no less than 27 distinct "diseases" so to speak, which a car-wheel is liable to contract in the course of its manufacture, and it must pass a rigid inspection in the quarantine or "cleaning shop" before it receives the required guarantee of its maker that it is "free from all defects."

Finally, having obtained a clean bill of health from the inspector, the wheel passes to the machine-shop where the hub is bored out, the axle fitted in by hydraulic pressure (of 15 or 20 tons) and the wheel and its mate are ready to start out on their long journey. If they are well matched they should roll along through their whole life without jarring, and, barring "accidents," will often travel 150,000 miles before becoming completely tired out.

The chilled cast-iron car-wheel is a purely American invention, and the method of annealing, which alone made this process practicable, was devised by a manufacturer in this city as long ago as 1847, since which time between one and two million wheels have been made in the works established by him, and have been shipped to all parts of the world where the shriek of the locomotive whistle has penetrated.—*Philadelphia Public Ledger*.

Durability of Cross-Tie Timber.

In an investigation of this subject made by Mr. F. B. Hough for the Department of Agriculture, some interesting facts are brought out. The relative importance of the various kinds of timber for railway purposes are reported in the following order: Oaks, pines, chestnut, hemlock, cedars, tamarack, cypress, elms, ash, cherry, black walnut, firs, spruce, beech, locust, redwood, maple, butternut, coffe-nut, mulberry and mosquit.

The average durability of oak, as reported in 32 cases, is 7.4 years, while the average price of each cross-tie is 41.2 cents. The kind of oak is not specified. For white oak the average durability in 152 reported cases is 7.3 years, and the average price in 173 cases is 40.6 cents. The average duration of a post oak tie is 7 years, and average price 33 cents. For burr oak, durability, 7.4 years; price, 37.3 cents. Rock oak showed an average durability in 18 cases of 7 years; price, 42 cents. In the case of red oak 5 years is the average durability, with an average cost of 27 cents. Chestnut oak is more durable, showing an average lifetime as a tie of 7.1 years; cost 28 cents per tie. Black oak shows an average durability of 4½ years; average price, 43 cents.

Long leaf or southern pine will last on an average 6½ years; average cost per tie, 37 cents. White pine has about the same durability with less cost, the latter showing an average of 31½ cents per tie.

Cedar shows the greatest average durability, being 11.8 years, with average cost of 34 cents, but it is too soft to bear heavy freightage and for that reason is not much employed in railway construction. Red cedar is more durable than white cedar, being in the proportion of 11 to 7. Cypress shows greater durability than white oak, the former showing an average of 8.7 years. White ash and black ash rot very quickly, the former in 4.3 years and the latter in 3.8 years. Cherry is a durable timber when used as cross-ties, running from six to ten years, All woods are much more lasting when hewn than when sawn.

The redwood of California makes very durable ties, lasting over eleven years, but allowance must be made for the fact that they are used on the Pacific roads, in a dry climate, where the causes inducing decay are not so great as in the States east of the Rocky mountains. The growth of the redwood is very slow. Trees fifteen years old have a diameter of only ten or twelve inches and will make about three ties. When younger than this the wood is not durable. The redwood of the Santa Cruz mountains furnishes the best ties, it being much heavier and denser than when grown further north. The average cost of redwood ties is 40 cents. The total length of railway track in the United States is approximated at 150,000 miles. Assuming that the average durability of ties is seven years and the distance apart is three feet, there will be 2,640 to the mile, which is rather under than over the actual number employed, making the total number in use 396,000,000. Estimating one-seventh to be replaced every year the annual demand to keep up the present railways will reach 56,571,428. Supposing that an acre will supply 100 ties, which is a liberal estimate, it will require 565,714 acres annually to furnish the ties required by the existing lines of railways. For each mile of railway there will be an annual demand for 377 ties, requiring the cutting off of 3.77 miles. It will require thirty years on an average for trees to grow large enough for making cross-ties. The acres that must be kept in timber and growing will be 16,971,420 for supplying ties to the railway lines now in existence.

The increase in railway mileage, estimated by two decades, is about 4,150 miles annually. To construct the railways that will probably be built in the next ten years 109,560,000 ties will be demanded, the product of 1,095,600 acres of woodland. Allowing thirty years as the period of growth for ties, this would add 3,286,801 acres to the timber reserve for railways alone, making a total of 18,-996,570 acres as the needful reserve. Evidently this question is one demanding reach of statesmanship and a careful preservation of our present timber supply. The time is not far distant when one of the largest items in the construction expenses of our railways will be the one for cross-ties.

Painting Ironwork.

The point of prime importance, says the *Painters' Magazine*, is the actual condition of the surface when ready to receive the first coat. Upon this point rests the success or non-success of subsequent applications, for if not in proper condition no paint will prove permanently preservative. Now the best state is that where there has been formed upon the surface of the iron a film of black

oxide which has been, while hot, thoroughly permeated by and incorporated with a resinous or tarry covering. This covering insures perfect success, and its thickness may be increased from time to time by additional coats of paint. If, however, a layer of hydrated oxide (ordinary rust) be once allowed to form, the successive coats of paint will fall off, their separation from the iron being merely a question of time. During this time, also, the rust has been spreading under the paint. An instance of this may be seen after out-door riveted work has been in place for some time. Usually all the riveting is done before the final painting is begun, each rivet-head in the meantime being exposed to a damp atmosphere; the paint begins to peel off the rivet-heads long before it leaves the adjacent plates, and when this occurs nothing but thorough scraping will give the paint a chance to adhere again. So slight are the differences of manipulation which determine whether a given piece of work shall or shall not rust away, that they may all be found in the different methods of manufacture pursued now and formerly. Taking the case of a piece of ornamental ironwork, which in so many instances has come down to us in unimpaired beauty and condition, it would be now probably forged in detail in one part of a factory, drilled, filed and fitted in another, and when completely finished, be painted in three coats of best oil paint. Formerly the smith who forged the work punched the necessary holes at the same time, fitted his various pieces together as he went on, completing each piece as he proceeded, doing all the work with his hammer, and, to quote an old book of directions to good smiths, brushing his work over with linseed oil and suspending it for some time over a strongly-smoking wood fire. This will give at once a sort of elastic enamel coat, perfectly adherent and calculated to preserve the iron to the utmost. Of course, ironwork today is not made to undergo any such preparatory process, and the consequence is that we find it very difficult to produce good results in painting on iron surfaces. But it is pretty well established that the very best finish coat for iron is found in red lead, upon which any desired shade of lead paint may be placed with the best possible results.

Car-Coupling Tests by the Master Car-Builders' Association.

THE Master Car-Builders' Association, through its secretary, has issued the following notice:

The executive committee of the Master Car-Builders' Association, acting in accordance with the general instruction given by the Association at the last convention, will make a public trial of automatic freight-car couplers, at Buffalo, N. Y., on Tuesday, September 15, 1885.

The executive committee will be guided by the results of their trial in recommending several forms of couplers to the railroad companies for further test in actual service. They will watch the behavior of those selected couplers until one month prior to the next convention of the association, when they will prepare a report, and may recommend for universal adoption one or more different forms of automatic freight-car couplers.

All parties desirous of presenting freight car-couplers to the consideration of the Master Car-Builders' Association are invited to participate in this trial.

The following requirements must be complied with:

The couplers must be attached to each end of two freight-cars—preferably box-cars—both cars must be forwarded, freight prepaid, to J. S. Hammond, Agent, New York, Lake Erie and Western Railroad, Buffalo, N. Y. Any additional charges for switching, etc., will be charged against the cars before they are billed home, and should be paid by the consignee or party interested in the device. Full drawings and specifications, together with letters-patent, and any opinions on the device that may have been given by the Eastern or Western Railroad Association, or by the courts, and also a statement of the numbers and initials of cars equipped with the coupler and already in service, must be forwarded to the executive committee of the Master Car-Builders' Association, care of M. N. Forney, secretary, 71 Broadway, New York, prior to September 15. All cars intended for this trial should be on hand in Buffalo, by Saturday, September 12, so that the committee can have a full list of them.

The committee will not consider or investigate the merits of couplers represented only by models, drawings or other descriptions. An imperative condition of the trial will be that couplers submitted to the committee *must be applied to two cars* so that they can be tested at the time and place named.

The executive committee is not prepared to assist inventors or owners of patents on car-couplers in procuring cars to be equipped and delivered at Buffalo ready for trial. Negotiations of this character must be conducted directly between the owners of the couplers and the railroad companies. It will also be necessary for parties furnishing cars for this trial to arrange direct with the railroad companies for their return.

Notice of intention to take part in the trial giving the numbers and initials of the two cars that will be forwarded, should be addressed to Edwd. B. Wall, Columbus, Ohio, or to M. N. Forney, 71 Broadway, New York, who will also answer inquiries with reference to the proposed trials.

Railroad commissioners of the various States will be invited to be present at this trial.

By order of the Executive Committee.

M. N. FORNEY, Secretary.

A Ship-Railway in Nova Scotia.

A BANGOR dispatch says that prominent railway and shipping men in New Brunswick and Nova Scotia are just now interested in a project which is intended to revolutionize the coasting traffic and to develop the resources of the north shore of New Brunswick and Prince Edward Island. It is the construction of a ship-railway across the isthmus between Northumberland Straits and Chignecto Bay, the northern arm of the Bay of Fundy, by which a saving of over 300 miles can be made in a voyage from the north shore of Prince Edward Island to Boston or other ports in the United States. By the natural route vessels from the Gulf of St. Lawrence are obliged to make a circuit of Nova Scotia, which is a great obstacle, not only by reason of the distance, but also on account of the dangers of navigation along its rocky coast. Work has already been commenced on the road, and good progress is being made, the chief engineer being John Fowler, who constructed the underground railway in London, and who is now engaged on the bridge over the Firth of Forth. A London syndicate has signed a contract to furnish the money required for carrying out the project.

Railway Building in the West.

IN answer to the plenteous talk of overbuilding of railway industries, says the *Railway Reporter*, it has been pointed out that the northwest beyond the Mississippi has just begun to develop its use of railway facilities. What has been done in the east, and especially in the cluster of western States lying north of the Ohio and east of the Mississippi is to be repeated in the territory west of the last named river. The five States—viz., Ohio, Michigan, Indiana, Illinois and Wisconsin—include a territory of about 200,000 square miles, with about 30,000 miles of railway, or about one mile of line to each 8.3 square miles of territory. In the section including Minnesota, Dakota, Iowa, Nebraska, Wyoming and Montana, in which the large portion of the area in soil is similar to and quite as productive as the division named east of the Mississippi, are over 600,000 square miles, with about

18,500 miles of railway, or one mile of line to each 32.8 square miles. This country, especially Dakota and Western Nebraska and Wyoming, is now undergoing the same process of development witnessed in the States east of the Mississippi twenty-five years ago. The needs of the newer section for rail facilities are now no less pressing than those of the older section when first brought into cultivation. To afford the same facilities for transportation to the trans-Mississippi section as are enjoyed in the Ohio group of States will require about 70,000 miles of railway, or about 50,000 miles in addition to what has already been laid.

Railways in India.

AT present the total mileage of railways open for traffic in India is, according to the *Railway World*, only 12,014, which is insignificant and insufficient when compared with the enormous area, population, wealth, and possibilities of the empire. There are 15,560 miles open, under construction, or sanctioned, it is true, but the slightly larger total does not materially affect the comparison. Up to December 31st, 1884, the total capital outlay on the Indian railways and connected steamer services amounted to £155,450,366 (at the conventional 2s. the rupee), of which £105,319,144 had been expended by guaranteed companies, £42,924,893 on State railways, £3,783,065 on native States' lines, and £3,433,259 on assisted companies' lines. The gross receipts during 1884 amounted to £16,066,225, and the working expenses to £8,156,157, the total net earnings yielding a return of £5 1s. 9d. per cent., as against £6 13s. 6d. in 1883. The total number of passengers carried was 83,815,119, against 65,098,953 in 1883, and the aggregate tonnage moved was 16,663,007, against 16,999,264 tons in 1883. Dullness in the grain traffic diminished the receipts from goods, but of the 45 items of traffic, 27 show increases, so that the outlook may be deemed very hopeful.

The Convention of the Master Car-Painters' Association.

THE sixteenth annual convention of the Master Car-Painters' Association will be held at Toronto, Canada, opening on Wednesday, the second day of September, 1885, at 10 o'clock A. M., and continuing in session until Friday evening, September 4th, or until the business of the convention is complete. The committee of arrangements have visited Toronto, and selected the Rossin House as the headquarters of the association. Parlors have been secured at this hotel in which to hold the convention.

A general invitation is cordially extended to master car and locomotive painters throughout the United States and Canada to attend the convention, and also to become members of the organization.

The following list of subjects will be brought before the convention:

1. Why do Paints and Varnishes Crack, and What is the Reason that Cracks in the Latter are Usually at Right Angles to the Grain of the Wood? A. P. Sweet, Detroit, Lansing and Northern Railroad, Ionia, Mich.
2. The Inside Finish of a Passenger-Car, from the Foundation to the Finish, including Wood Head Linings. T. F. Page, Laconia Car Works, Laconia, N. H.
3. The Paint-Shop of Fifty Years Ago, and the Paint-Shop of to-day. D. D. Robertson, Michigan Central Railroad, Detroit, Mich.
4. Is a Car-Body Color Composed of One Durable Pigment more Durable than a Color Composed of Two or more Pigments? C. E. Copp, Boston and Maine Railroad, Lawrence, Mass.
5. A Few Thoughts on the Outside Painting and Varnishing of Railway-Cars. Wm. Davis, Canada Southern Railway, St. Thomas, Ont.
6. Is it Practicable to Prepare the Painting of a Passenger-Car, up to the First Coat of Body Color, before Placing on the Car; also on Freight-Cars up to the Last Coat of Color? Jos. Murphy, Louisville and Nashville Railroad, Louisville, Ky.
7. Piece Work in the Railway Paint-Shop. F. S. Ball, Pennsylvania Railroad, Altoona, Pa.
8. What is the Best Method of Cleaning Brass and Plated Car-Trimmings? E. L. Fetting, New York and New England Railroad, Norwood, Mass.

The First Railway in America.

IN the course of a paper read before the Franklin Institute, bearing the title "Transportation Facilities of the Past and Present," Mr. Barnet Le Van corrects the commonly received statement that the Granite Railroad, built at Quincy, Mass., in 1827, by Gridley Bryant, for transporting stone for the Bunker Hill Monument from the granite quarries of Quincy, was the first railway built in the United States. On this point he presents interesting testimony to prove that, far from being the first, the Granite Railroad was really only the fourth in order of precedence in the United States. We quote from that portion of the paper relating to the subject as follows:

"Railroads were also first introduced in Pennsylvania. In September, 1809, the first experimental track in the United States was laid out by John Thomson, (the father of John Edgar Thomson, who was afterwards the president of the Pennsylvania Railroad Co.), civil engineer of Delaware County, Pa., and constructed under his direction by Somerville, a Scotch millwright, for Thomas Leiper, of Philadelphia. It was 180 feet in length, and graded 1½ inches to the yard. The gauge was 4 feet, and the sleepers 8 feet apart. The experiment with a loaded car was so successful that Leiper in the same year caused the first practical railroad in the United States to be constructed for the transportation of stone from his quarries on Crum Creek to his landing on Ridley Creek, in Delaware County, Pa., a distance of about one mile. It continued in use for 19 years. Some of the original foundations, consisting of rock in which holes were drilled and afterward plugged with wood to receive the spikes for holding the sleepers in place, may be seen to this day."

Telegraphy in the United States.

THE United States has more than three times as many telegraph lines, double the number of telegraph offices, and forwards twice as many telegrams annually as any other country on the globe. The figures for the United States are: Length of line, 163,940 miles; number of offices, 14,402; messages sent last year, 57,942,247. Russia

comes next in miles of lines, with 53,736, but is far behind in number of offices and telegrams sent. France, Germany, Austria and Australia rank ahead of Great Britain in miles of line, having 45,878, 45,070, 31,131 and 21,831 miles respectively, though Great Britain with 31,345,861 telegrams, forwarded, sends a few more than one-half the number sent last year in the United States. In number of offices in Europe, Germany with 7,366 has the most and Bulgaria with 37 the least.

The English Railway Commission.

THE eleventh annual report of the English railway commission has been issued. Fourteen cases were brought before this court during 1884. The commission also approved five working agreements between the railway companies, a fact which leads one journal to remark that the companies "recognize that it offers them manifest advantages as arbitrator in their own disputes, for out of the fourteen cases seven related to disputes between the companies themselves, and only five referred to complaints by traders against railway companies. This is different from the experience of the early days of the commission, when nearly all were complaints of freighters." During the past nine years 125 cases have been presented for judgment, and 47 working agreements have been approved. Four of the cases referred to for 1884 were concerned with terminal charges.

A Great Railway Bridge in Australia.

A GREAT railway bridge 3,000 feet long is to be built over the Hawkesbury river, New South Wales, Australia. The soundings appear to show that the foundations for piers must be sent down to a greater depth than any ever sunk in the whole history of engineering, the water in some places being 77 feet deep, and in others, where the water is 45 feet deep, the mud and sand are 125 feet deep, making 175 feet in all, to sink the piers below tide. This bridge is to be for double lines and will cost over £400,000. Sir Saul Samuel, of London, on the part of the government, has named a board of engineers to meet in London to examine and report on the plans and tenders sent in by the bridge builders. The board named consists of Sir John Hawkshaw, C. E., Col. Douglas Galton, and Mr. W. W. Evans, M. I. C. E., of New York.

The Smallest Locomotive.

THE Central wharf railway-shops, at Pensacola, Florida, have recently made the smallest locomotive ever built in the United States for regular service. The engine is for a 20-inch gauge road. The cylinders are 5 by 8 inches; driving-wheels, 12 inches in diameter; 4¾ feet is the greatest height above the rail, and it has 97 tubes, 1½ inch in diameter. The tank holds 180 gallons of water, and the coal-bunkers have a capacity of 250 pounds. The whole machine is only 9½ feet long, 7½ feet wide, and weighs in working order 3½ tons. It has attained a high rate of speed, pulls 15 loaded cars, weighing about 45 tons, and handles them easily. A pressure of 80 pounds is carried.

A Singular "Cut."

FREIGHT is hauled on most of our railways at such a low rate that craft on free water-courses can hardly compete with rail tariffs. Under this state of matters, says the *National Car-Builder*, it is curious to read that a railway has been compelled to lower its rates, owing to the competition of ox teams. Yet, in this year of grace, that is what the Canadian Pacific has been forced to do. The reduction was to $30 per ton for a haul of 160 miles. Some railways in the United States would be glad to get one of the thirty dollars for the same haul.

Freight-Rates in Mexico.

THE Mexican Government has officially notified the Mexican Central Railroad that it must comply strictly with the terms of its concessions and the provisions of the general railway regulations forbidding inequalities of of freight-rates, and that special through rates from the United States cutting under the Mexico freight tariff cannot be permitted. The government also warns the company that it shall investigate cases of alleged freight-rate cutting, and if proved legally the fixed penalties will be enforced.

Railways in Chili.

THE republic of Chili now owes on account of her railways $24,870,000. In 1883 these railways earned a revenue of $6,516,049 on a capital of originally less than $60,000,000, and which is now reduced to $22,450,000. Good management and liberality on the part of the government have brought about this splendid financial result.

The Cost of Stopping a Train.

EVERY stop of a train costs money to a railway company. Recent statistics kept on a certain trunk line showed that during a given year the 350 daily trains made 7,000 extra stops every twenty-four hours, the traffic being largely suburban. Experiments showed also that each stop cost 42 cents, reckoned largely in extra time to employés who for that number of stops aggregated 350 extra hours per day, making a total loss to the company of nearly $50,000 a year.

Keely Surpassed.

IT is stated by the *Railroad Gazette* that at one of the fairs of the Massachusetts Charitable Mechanics' Association in Boston, the management forbade any fires in the building; and, as a consequence, exhibitors of portable engines considered that they were deprived of opportunities of showing the operation of their class of engines. One exhibitor showed resources equal to the occasion, for he connected the exhaust pipe of one engine in his exhibit to the boiler of another of his engines, removed the safety valve, and connected the flywheel by belting to the shaft which was kept in motion by the main engine of the Exhibition. This method of driving an engine furnished a supply of compressed air in the second boiler, whence it was used for motive purposes. Soon the manager learned that these portable engines were in operation, and assuming that the regulations concerning

fire were necessarily violated, sent a worthy colored messenger to examine and report the facts to him. After looking these engines over very carefully, he reported that they were running the engines in question with the "northwest wind or something or other." A group of laborers were examining the engine, and one of them gave his opinion that "cold steam and no fire was the greatest invention yet."

Specific Gravity of American Woods.

ACCORDING to *Wood and Iron*, of the four hundred and thirteen species of trees found in the United States, there are sixteen species whose perfectly dry wood will sink in water. The heaviest of these is the black ironwood (*Condalia ferrea*) of Southern Florida, which is more than thirty per cent. heavier than water. Of the others, the best known are the lignum vitæ (*Guaiacum sanctum*) and mangrove (*Rhiziphora mangle*). Another is a small oak (*Quercus grisea*), found in the mountains of Western Texas, Southern New Mexico, and Arizona, and westward to the Colorado desert, at an elevation of five thousand or ten thousand feet. All the species in which wood is heavier than water belong to semi-tropical Florida or the arid interior Pacific region.

A Railway in China.

THE Chinese Government has contracted with a Manchester, England, firm for the construction of a railway from Takou, at the mouth of the Hoen-Ho, on the Yellow Sea, to Tong-Chow, on the Pet-Ho, a point about twenty-five miles east of Pekin. The railway will be about one hundred miles long, and will give Pekin a direct and easy communication with the Yellow Sea. China is now engaged in raising in Europe a loan of 100,000,000 florins to be expended in internal improvements.

Railways in Indiana.

THE State Board of Equilization of Indiana reports the extent and value of the railways of the State as follows: Length of main track, 5,445 miles; valuation, $39,509,509. Second main track, 68 miles; valuation, $402,260. Side track, 1,051 miles; valuation, $2,505,958. Rolling-stock, $11,095,428; improvements on right-of-way, $1,470,838. The figures for 1883, as reported, were as follows: Main track, 5,429 miles; valuation, $39,150,690; second main, 68 miles; valuation, $405,580; side, 990 miles; valuation, $2,709,948; rolling-stock, $11,345,113; improvements, $1,429,356. The total increase in the valuation of railway property in the State is $349,439.

The Electric Light on Railway-Cars.

THE Pennsylvania Railroad Company continue their experiment with lighting their cars by electricity from Brush storage batteries. They use the lights on a train running between Altoona and Pittsburgh, and the arrangement has worked satisfactorily. The storage batteries are charged in the company's shops by connection with a Brush dynamo-electric machine. It takes about nine hours' running to charge the batteries with sufficient electricity for the round trip. The intention is, should the plan be found advisable for general use on through trains, to establish electric plants at different stations for charging the batteries.

The Longest Draw-Span in the World.

THE Passaic Rolling Mill and Bridge Works, of Paterson, are building what will be, when finished, the longest draw-span in the world. It is to be four hundred and thirty feet long, will weigh about five hundred tons, and consist of iron and steel in the proportion of three to two. The machinery for latching, lifting the ends, and turning the draw is all to be worked from the center of the span, and is fitted to be operated by either hand or power. The turn-table is rim-bearing, turning on fifty wheels eighteen inches in diameter. The diameter of the drum is twenty-five-and-a-half feet. It is for the new bridge which the Minnesota and Northwestern Railway is constructing across the Mississippi River at St. Paul. The length of the entire bridge will be 1,430 feet.

THE largest boiler constructed for any locomotive at the West Albany shops of the New York Central road is now under way. It has a 52-inch shell, two inches larger than any other, made of $\frac{7}{16}$ inch iron. There will be 228 tubes, twenty-eight more than in any other boiler, and it will carry 160 pounds of steam. The boiler is 16 inches higher than the usual run, and all told weighs over eight tons.

PREPARATIONS are being made on the New York Central road for scooping water instead of making stops at the tanks. The engines of fast freight and passenger-trains are to be supplied in this way. The troughs will be constructed first at a point west of Palatine Bridge, and will be 1,200 feet in length. Scooping attachments have already been affixed to several of the road's locomotives.

THE fourth annual meeting of the American Forestry Congress will be held in Horticultural Hall, Boston, Mass., beginning on September 23d, under the auspices of the Massachusetts Horticultural Society, in conjunction with the New England Agricultural Society, the Massachusetts Board of Agriculture, and the Society for the Promotion of Agriculture.

THE six great French railway companies estimate that they will have to purchase additional rolling-stock next year to the aggregate value of £2,247,200. It appears from the detailed estimates prepared upon the subject that the largest orders will be given out by the Paris, Lyons and Mediterranean, and the Orleans companies.

THE Pennsylvania Company recently presented its employés, at Pittsburgh, with a library, reading-room, assembly hall and bath-rooms.

AN underground line is to be built in Naples, the largest city in Southern Europe. The stations, etc., are to be lit by electric light.

FRANCE is stated to possess more suspension-bridges than any country in the world.

American Railroad Journal.

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Principal Contents of this Number.

CONTRIBUTIONS.

(*Written for the American Railroad Journal.*)

EDITORIALS.

MISCELLANEOUS AND SELECTED.

STREET-RAILWAYS.

NEW INVENTIONS.

A BAD YEAR FOR RAILWAYS.

THE year 1884 was not one that affords pleasant retrospection. It was a year characterized by dullness in trade and a number of unsavory financial failures that should lead us to forget it as soon as possible. Naturally it was not a good year for railways, but it is doubtful if it was thought to be as bad as subsequent investigation has demonstrated. "Poor's Manual" for 1885 as usual conveys the minutest information concerning railway progress during the past year and the information is as valuable as it is depressing. Wherever there should be an increase there is a most discouraging decrease, and wherever, in a healthy business year, there should be a decrease there is an increase.

Briefly summarized, there were at the close of 1884, according to Mr. POOR, 125,379 miles of railway in the country of which but 3,977 miles were constructed during the year, showing an increase of but 3.17 per cent. The share capital of this mileage equaled $3,762,616,686 as against $3,708,060,583 in 1883, an increase of but 1.4 per cent., and the funded debts of all the lines equaled $3,669,115,772 as against $3,500,879,914 in 1883, an increase of $168,235,858, or of nearly 5 per cent. This is a sorry showing and we are not surprised at the statement that "the country is now about at its lowest depth so far as railroads are concerned." In the face of this meager showing it is hard to believe that 40,000 miles of railway were constructed in this country during the five years ending with 1883.

In the matter of traffic earnings there is little improvement in the bad showing made in railway construction. The gross earnings of all lines from which returns were received during 1884 amounted to $770,684,908, a falling off of $53,088,016 from the previous year; a decrease of about 6.4 per cent., or of $798 per mile. The net earnings of all the lines in 1884 equaled $268,106,258, a falling off of $25,261,027 from the net earnings of the previous year; the rate of decrease being about 9 per cent. In the matter of passenger and freight transportation there was a slight increase, but, of course, a decrease in the amount paid per mile for transportation; and it is shown that the decrease in earnings was wholly due to the reduction in rates charged. Had the rates for passenger and freight transportation prevailing in the year 1883 been maintained in 1884 there would have been a materially better showing, and instead of a decrease from the gross earnings of the previous year there would have been an increase of $3,752,447; not a large increase it must be confessed, but, nevertheless, a margin in the right direction. All around the falling off is properly stated as phenomenal, and considering the number of leading lines in receivers' hands there is at present a dismal blueness in the railway atmosphere. The true state of our railway industry can only be obtained by a

thorough inspection of the Manual, but it takes a very little investigation to reach the conclusion that there is something wrong with our railways. Possibly "over-production" hassomething to do with it, and railway construction has been pushed more rapidly than was warranted by the needs of the country; possibly, and probably, absurd competition has contributed to the depression, and certainly unscrupulous and bad management are responsible, in great part, for the poor showing of the year.

RAILWAY JOURNALISM.

SOME of our esteemed contemporaries are exercised over apparent slights to the dignity of the railway press. They indignantly repel suggestions to the effect that their publications are not essential to the management of railways, and boldly avow that they are factors of the greatest importance to the railway world and exercise a powerful influence both for weal and woe. The "weal" part of it we will admit, but we do not comprehend the influence for "woe" that our worthy brothers of the press boast of wielding. We hold to the opinion that a railway publication is a trade paper of the higher class, offering benefits to the industry in whose interests it is published, and receiving in return adequate compensation in being furnished a field of action in which it can flourish and obtain sustenance. It is to the interest of railways to encourage railway publications and extend them a helping hand, and it is to the interests of the railway publication to labor faithfully for the advancement of railway interests. It is a simple case of mutual benefit, and the railways and the railway publications should work harmoniously for common ends.

Certainly it seems to us not only impolitic and contemptible for railway papers to insinuate that they can injure the industry whose interests they are supposed to foster, but also absurdly untrue. While we believe in the usefulness of railway publications, we candidly admit that were they one and all to suspend publication, the railways of the country would still continue in active operation. The injury which the publications could inflict is merely of a negative character in depriving the railways of the benefit of mediums of communication, and interchange of opinions. Any attempt on the part of a railway paper to injure the character and financial standing of a road would meet with lamentable failure, even if there were several grains of truth in the allegations that might be made.

In the connection of railways with railway journals the question of passes plays a most important part. Several of the publications assume that an annual pass is not only a recognition of the service rendered to a road by the journal, but a perquisite which should be furnished as a matter of course. From this view we beg leave to differ. While it is perfectly proper for those conducting railway publications to apply for complimentary transportation upon any railway, the granting of such an application is an act of courtesy on the part of the railway official and should be regarded as such. It is an act of courtesy for which no return is demanded and the recipient is not under a weight of obligation to return the favor; but it is one of those little amenties of intercourse which do not come under the strict rules of business, and should a request of this sort be denied we fail to see that the applicant has a cause for grievance. To be sure he may consider with truth that the rejection of his application was not courteous and that the particular official to whom he applied was not overly obliging, but these little incidents have nothing to do with the actual business of a railway publication.

Again, unfortunately, there are too many trade publications whose sole aim and object is to extort money in one form or another from the trade which it represents, and to derive sustenance through a species of blackmail, but fortunately the railway papers are free from this fault almost throughout the whole extent of railway journalism, and we regret the utterance of the merest insinuation that the publications have it in their power to visit reprisals upon the roads who for one cause or another do not recognize the value of that branch of the trade. The only proper way for railway journalism to be conducted is as a business—a business where no favor is sought and where the general interests of railways are alone consulted, irrespective of whether or not the usefulness of the publications have met with recognition by particular roads. If a few roads do not perceive the advantages accruing through the publication of a number of journals devoted to railway interests, these roads are more to be pitied than blamed.

EDITORIAL NOTES.

A VALUED contributor writes us as follows:

"In the last issue of the JOURNAL it is stated that "Uncle Gad Lyman," recently deceased, was, on the authority of his brother engineers, the oldest locomotive engineer not only in the United States but in the world. This is not true. The undersigned in the year when Lyman claims first to have handled a throttle (1839) was running the mail-train on the Petersburgh and Richmond Railway, being at that time unquestionably the *youngest* engineer of a locomotive in the world, not being seventeen years of age."

The cry is still they come. Verily the oldest engineer multiplyeth on the face of the earth and he even resembleth his compatriot, the "oldest mason." It still remains, however, for the above record to be beaten.

* * *

OUR enterprising contemporary, the *Railway News*, foams with rage and soundly cudgels our unhappy friend "Superitendent," the author of two recent articles in the JOURNAL on the subject of promotion in railway service,

and even the JOURNAL comes in for a few sounding thwacks. Our serenity is disturbed by an insinuation that our publication is "alleged" to be devoted to railway interests. Grievous as is the allegation, we shall endeavor to survive it. We wrote our friend "Superintendent" asking him if he wished to reply to the *News*, in the full knowledge that he would view the ferocious attack made upon him more in jest than in anger, and he sends us the following in reply:

"Under the circumstances I think it would be well to close the discussion, at least for the present. The subject is an interesting one, and I would have been glad to have continued the discussion of it if it could have been conducted in moderation and in courtesy; but, I confess, when my opponents resort to personal abuse, I am silenced. That is a weapon I am not fond of employing. . . . . The amusing part of it is that the whole animus prompting the fiery onslaught of the *News* is found in the fact that I heedlessly alluded to it as "another railway publication." Now I can say honestly that I meant no slur in so characterizing it, but I really do not see how I can apologize for my thoughtless language. The only apology possible would be one similar to the famous apology made by a character in one of Captain MARRYAT'S novels, who upon being overheard to remark that his superior officer was "not fit to throw guts to a bear," was forced to make an apology before the ship's company, which he cheerfully did, retracting the assertion and remarking that the gentleman *was* fit for that pleasing occupation. Now I cannot apologize for calling the *Railway News* another railway publication without saying that it is *not* another railway publication, which, to tell the truth, would do injustice to that exceedingly readable and progressive publication toward which I bear no malice, but which unfortunately has not the respect for me that I have for it."

* * *

THE Convention of Master Car-Painters to be held in Toronto next month, is an event of interest in railway annals and expectancy awaits upon the deliberations of the artists of the rail. The papers to be read at the convention are unusually numerous and varied, and it will give us pleasure to put them before the readers of the JOURNAL as quickly as possible.

* * *

THE fastest run ever made is reported by the New York, West Shore and Buffalo road, a special train on that road running from East Buffalo to Frankfort, a distance of 205.1 miles in four hours, maintaining a speed of from 75 to 85.7 miles per hour. This is something like, but we are a little disposed to doubt the statement that it was the fastest run ever made. Nevertheless it is pretty fast for these times. In years to come, we confidently look to see a hundred miles per hour reached, GEORGE STEPHENSON to the contrary notwithstanding.

* * *

THERE is something peculiarly childlike and bland in the extended argument published in an English railway journal, urging that railways should be represented in Parliament. If the writer should sojourn long with us he would discover that in America, so public opinion seems to indicate, the difficulty is to keep railways out of legislative bodies.

MASSACHUSETTS is generally at the front in all matters appertaining to railways, and we are not surprised at the agitation that is there being made in that State against the indiscriminate blowing of locomotive-whistles. In fact, we regard the locomotive-whistle very much as we do the church-bell. It was very useful in its time, but now with the vast improvement in railway-signals and safety-switches the use of the whistle is very much circumscribed.

* * *

A NOVELTY in the way of expositions will be the American Exhibition to be held in London next year. As an exclusively "Yankee" show given on foreign soil, patriotism should stimulate us to show our British cousins what we can do three thousand miles off, and, doubtless, there will be more genuine interest taken in the exhibition than if it were to be given here at home.

* * *

VERILY we are flooded with notices of Expositions and Exhibitions. In addition to the Philadelphia Novelties Exhibition and the American Exhibition in London, and the "second edition" of the New Orleans Exhibition, we are further reminded that the Permanent Exhibition of the United States of America will open in Rome under the auspices of the ministers of Agricultute, Industry and Commerce of Italy, and of the consul-general of the United States.

MR. J. D. SIBLEY, architect and builder, and Mr. A. O. Kittredge, editor of *Carpentry and Building*, have compiled a little work entitled "The Practical Estimator," which is published by David Williams, at 83 Reade street, New York. The work is a key to "The Handy Estimate Blanks," published by the same house; and together they furnish a most valuable assistant to the carpenter and builder. Every item is considered and the builder is saved much time in forming his estimates.

Dixie, a southern monthly magazine published by the Dixie Company, of Atlanta, Ga., makes its appearance with every indication of a prosperous future. The first issue is an excellent one and its contents are of varied interest, while a special announcement promises a second number of unusual merit.

The Philatelic Journal of America is received, published by E. M. Hackett, of St. Louis. As its name indicates it is a publication devoted to the interests of stamp collectors.

IN their *World Travel Gazette* for August, the World Travel Company, of 207 Broadway, New York, offer a number of attractive routes to the tourist at reasonable rates.

The St. Louis Medical Journal for August, contains a number of articles of interest to laymen as well as to the profession.

WITH its September number, *Outing* completes its sixth volume. As usual the publication calls for unqualified praise.

Street-Railways.

American Street-Railway Association.

President.—Calvin A. Richards, President Metropolitan Railroad Company, Boston, Mass.

First Vice-President.—Julius S. Walsh, President Citizens' Railway Company, St. Louis, Mo.

Second Vice-President.—Henry M. Watson, President Buffalo Street Railroad Company, Buffalo, N. Y.

Third Vice-President.—Edward Lusher, Secretary and Treasurer Montreal City Passenger Railway Co., Montreal, Canada.

Secretary and Treasurer.—William J. Richardson, Secretary Atlantic Avenue Railroad Company, Brooklyn, N. Y.

Office of the Association, cor. Atlantic and Third Avenues, Brooklyn, N.Y.

The Fourth Annual Convention of the Association will meet in St. Louis, Mo., on October 21st, 1885.

IS IT TO BE THE STREET-RAILWAY OF THE FUTURE?

ELSEWHERE in this department we print extracts from a notice recently issued by the Bentley-Knight Electric Railway Company, of this city, and upon reading these extracts the question naturally presents itself: Is the electric road to be the street-railway of the future? We are not disposed to assume that the Bentley-Knight system is the only practicable system of electric roads in existence, but it is certain that the company controlling this system are able to point to one road in successful operation in Cleveland, and to exhibit figures showing the advantages of their system over those of horse and cable roads. It is not to be supposed that this company advance arguments in the shape of estimates that cannot be sustained; and their offer to build and equip a road and demand no payment until their claims are substantiated, is certainly one calculated to inspire confidence in their assertions.

The estimates of the Bentley-Knight Company are based upon the cost of construction and maintenance of an average city road, operating five miles of double-track and running forty cars. In the question of cost of construction as between a horse, cable and electric road, it is seen that the horse road calls for an outlay of $162,000; the cable road, $414,750; while the electric road comes in between the two with an outlay for construction of $344,100. In the matter of annual expense of motive-power, the horse and cable roads reverse their relative positions in the above estimates, the horse road costing annually for motive-power $102,960, by far the greatest sum, the cable road, $75,590, while the electric road calls for an expense for motive-power of but $30,551.50; less than one-third the cost of motive-power of the horse road, and less than one-half that of the cable road. Thus the saving in annual expense of motive-power in the adoption of the Bentley-Knight system over that of horse and cable roads, is in the first instance, $72,408.50, and in the second, $45,038.50. It is furthermore shown that the cost of changing an existing horse road to an electric road is $257,100, and the cost of changing an existing cable road to an electric road, $113,600, while the saving in motive-power annually effected is, in each case, over one-fourth the total cost of changing the road to an electric road, or a return of over twenty-five per cent. per annum from the amount expended to adopt the electric system.

It is fair to assume that these estimates have been carefully computed, and are the results of months of careful study by experts and engineers. We confess they startle us not a little. While it is quite possible that the Bentley-Knight system will, in time, be greatly improved, and that other systems equally good will be introduced, the above-mentioned estimates speak for themselves and again we are prompted to ask: Is the electric road to be the street-railway of the future?

THE Board of Aldermen of New York City have granted a franchise to the Fulton, Wall and Cortlandt Street Railroad Company, and at last the city will be furnished with a long-needed means of cross-town communication in the lower portion of the town. We trust this road will be but one of several of its kind, for easy communication between the North and East rivers is of immense importance. The granting of this franchise is an indication of the rapidity with which public opinion changes. Two years ago it would have been deemed absurd to construct a surface road crossing Broadway on a level at any point down town, and the suggestion of a road on Broadway itself would have been scouted.

UTILITY IN STREET-CAR PAINTING.

BY A CAR-PAINTER.

[Written for the AMERICAN RAILROAD JOURNAL.]

THE car-painter has two tasks to perform: he must turn out a handsome job and a useful job. Not only must a street-car be artistically painted, but *usefully* painted, and this is seldom done. The car-painter is not responsible for this, for the prevailing mode of painting street-cars is to make them as gaudy as possible with little reference to useful features. Now a handsomely painted street-car is a handsome thing, and considerable ingenuity has been called into play in painting panels and sides of cars. They are painted of every hue, in red, white, blue, green, yellow, purple, plaid, and in combinations of various sorts, but the occasion is rare when the side panels of a car are devoted to their proper use—to bear the destination and route of the car. The destination and route of the car are generally painted in small letters just under the roof, which may be read with ease at a distance of a hundred feet, but not more; whereas the side panel affords a chance for them to be painted in letters a foot long and visible a block off. If the public were consulted it is likely that they would prefer

to dispense with the elaborately painted car, and be furnished with one that carries its destination and route with it in sufficient clearness to be read at a reasonable distance. The inside of a car is the place for decoration; not the outside. Everything on the outside should be devoted to utility.

A friend of mine has devised an ingenious system of car-painting which he declares will be the system of the future. He presupposes that all the roads of a large city are under one management, or, at least, have decided upon a common system of painting; and upon this assumption he has devised a system of street-car painting that applies to every line of cars in one city. All cross-town cars are to be painted in one general style, and the up-and-down-town cars in another. These cars are also lettered to indicate whether they run east and west, or north and south, the letters "N. & E.," "S. & W.," being painted in bold figures on each side and end of the cars. Presuming that the termini of a road are points of interest, or stations of railways, he has further devised a system of disks on which appears the precise time at which the car is due at the terminus toward which it is running, these disks being shifted at the end of each half-trip. The number of the car which is generally painted in large figures on the side of the car, and which the public care little about, is relegated to the front and rear dash-boards of the car which are practically of little use for other purposes.

In the interior of the car he has utilized the small panels generally devoted to advertisements for the insertion of cards giving information as to the connections made with other roads. Thus the first panel from the rear end of the car will show the first connection, and the second panel the second connection, etc., the two sides of the car being furnished alike with these cards.

In this general system every latitude is allowed for ornamentation and originality apart from the side exterior panel, which is reserved for a uniform style of painting. The painter can do as he pleases with the rest of the car, but that panel is reserved for utility and not for ornament.

It is doutful if my friend's plan will meet with general adoption, despite his hopefulness and confidence; but in the direction of usefulness much can be done in the way of street-car painting. At least, the various roads in this city should adopt a general system of painting their cars that would prevent confusion of different lines, and there is no reason why the route and destination of the car should not be painted where it can be most conspicuous—on the side of the car. Handsome lettering is just as artistic as scroll-work and a great deal more useful.

THE BENTLEY-KNIGHT ELECTRIC RAILWAY.

THE Bentley-Knight Electric Railway Company, of 115 Broadway, New York, have just issued a general notice to street-railway companies, from which the following extracts are taken.

"The Bentley-Knight electric tramway having been in commercial use on the East Cleveland Horse Railroad, at Cleveland, Ohio, since August, 1884, and having successfully solved the problem of city surface roads by experiments conducted in the heat of Summer and during the extreme cold and heavy snows which, at Cleveland, distinguished the Winter of 1884—5, and the company, having completed its arrangements with the Rhode Island Locomotive Works for manufacturing upon a large scale, is prepared to enter into contracts to build and equip electric tramways, or street-railways, complete in all details, either entirely new and over unoccupied routes, or to replace horse, steam, or cable roads now in operation—surface, elevated, or underground. The Bentley-Knight Electric Railway plant consists of a stationary source of power, engines, boilers, and dynamo-electric machines, which may be located at an extreme end of the line, at tide-water, or at a railway station, wherever property or fuel is cheapest; a conduit running from the source of power to and along the whole length of the line, containing stationary and permanent conductors, which receive and distribute the electric current to the motors placed under the cars and geared to the axles; and a depending conductor which, passing through a slot in the conduit and sliding in contact with the stationary conductors, maintains unbroken connection with the source of power. All the parts are of the most substantial and enduring character.

"The direction and speed of the car are controlled at will by the driver from either end, the power consumed being always proportionate to the speed. Movement from rest to a speed of fifteen miles an hour in either direction is accomplished by the movement of a single lever. The driver can therefore proceed slowly, almost imperceptibly when required, and take any desired speed to recover lost time. The operation of the lever requires no exertion and the ordinary horse-car drivers are employed indifferently for both duties.

"The conduit which contains and protects the electric conductors is kept perfectly clean by brooms attached to some of the cars. The facility and perfection with which the small conduit is kept clean commends the system to the approval of sanitary boards.

"Each car is entirely independent of any other, and any car, generator, or engine may break down without interrupting the traffic. A car disabled through accident would be pushed to the depot by the succeeding one. An engine or dynamo may be cut out for any reason and at any time, by increasing the speed of others. The independence of the motors and expansibility of the motor power renders the system wholly independent of horses or other reserve. The power consumed is proportioned to the number of cars operated, and (neglecting interest on plant) one car may be run with nearly as great economy as twenty.

"Cars may be stopped as quickly as desired, may reverse to avoid a block, and be replaced on the track (if derailed) by the motor without injury.

"Powerful sweepers and snow-ploughs, driven by motors supplied from the same conductors, serve to keep the road in good condition during the heaviest winter storms. The same cars which run in city streets at from six to eight miles an hour, may be speeded to fifteen or twenty miles on suburban extensions, thus saving change of cars and accomplishing rapid average time on long lines, or lines uniting villages or neighboring towns.

"In applying the Bentley-Knight electric system to a horse-road in operation, it is not required to suspend the traffic. A line may be extended at any time without difficulty.

"The machinery on the car has no reciprocating parts; there is therefore no lateral hammering, the motion is smooth, and the wear and tear greatly reduced. The absence of machinery along the line requiring attention and oiling, and the automatic brushing of the track and conduit, contribute to diminish the cost of labor.

"Although the body of the car is supported upon the motor-truck, it may be so adjusted that closed bodies may be used in winter and open in summer, and closed cars with motors may pull open cars without motors.

"The Bentley-Knight Electric Railway Company submits comparative estimates of the prime cost and expense of construction and maintenance of electric, cable, and horse railways, and estimates for changing horse and cable roads into electric roads with stated economies. The figures will vary somewhat in different localities, inasmuch as material, labor, fuel, and animals vary in value, but are approximately accurate for New York City. In considering relative cost it must be borne in mind that both the cable and electric systems may "double up" cars without materially increasing the cost for power or labor, while the horse-lines must frequently double up power to carry the single load. This is not taken into the account, but it consitutes a formidable item."

The Bentley-Knight Company also furnish the following comparative estimates as to cost of construction and maintenance of horse, cable and electric roads:

No. 1.

COST OF BENTLEY-KNIGHT ELECTRIC TRAMWAY.

Estimate on cost of building and equipping an electric tramway operating 40 cars over 5 miles of double-track; headway 2½ minutes; average speed 6 miles an hour.

Track, 10 miles, at $5,000	$50,000
Cars, 40, at $800	32,000
Conduit, 10 miles, at $11,660	116,600
Steam-power plant	27,500
Building and foundation	11,000
Dynamos	44,000
Motors, 40, at $1,200	48,000
Engineering	15,000
	$344,100

ANNUAL EXPENSE OF MOTIVE-POWER:

Coal, 5 tons per day, at $2.50	$4,562.50
Engineer and assistant	1,500.00
Firemen (3)	1,800.00
Lubrication	540.00
Interest on motive plant, 6 per cent. of $246,100	14,766.00
Maintaining plant, 3 per cent	7,383.00
Total	$30,551.50

No. 2.

HORSE TO ELECTRIC (B-K. SYSTEM).

Estimate on cost of changing an existing horse tramway into an electric tramway; 40 cars and 5 miles of double-track.

Conduit, 10 miles, at $11,660	$116,600
Steam-power plant	27,500
Building and foundation	11,000
Dynamos	44,000
Motors, 40, at $1,200	48,000
Engineering	10,000
	$257,100

Annual expense for motive-power as by estimate No. 1, $30,551.50.

No. 3.

CABLE TO ELECTRIC (B-K. SYSTEM).

Estimate on cost of changing an existing cable road into an electric tramway; 40 cars and 5 miles of double-track.

Conductors, 10 miles, at $1,000	$10,000
Insulators	9,600
Dynamos	44,000
Motors, 40, at $1,200	48,000
Engineering	2,000
	$113,600

ANNUAL EXPENSE OF MOTIVE-POWER.

Coal, 5 tons per day, at $2.50	$4,562.50
Engineer and assistant	1,500.00
Firemen (3)	1,800.00
Lubrication	540.00
Interest on motive plant, 6 per cent. on $113,600 + $414,750, original cost of cable plant	31,701.00
Maintaining plant, 3 per cent	15,850.50
	$55,954.00

No. 4.

COST OF HORSE TRAMWAY.

Estimated cost of laying and equipping a horse tramway having 5 miles of double-track and operating 40 cars:

Double-track, 5 miles, at $10,000	$50,000
Cars, 40, at $800	32,000
Horses, 360, at $125	45,000
Building	35,000
Total cost	$162,000

ANNUAL EXPENSE OF MOTIVE-POWER.

Feeding, replacing, and caring for 360 horses, at $234 per year	$84,240
Interest on investment at 6 per cent	9,720
Maintaining horse-stables' plant	9,000
Total	$102,960

No. 5.

COST OF CABLE ROAD.

Estimated cost of cable road; 5 miles of double-track, operating 40 cars:

Double-track, 5 miles, at $56,650	$283,250
Steam-power plant	25,000
Building and foundation	40,000
Curves	8,000
Driving-machinery and sheaves	7,500
Cars, 40, at $900	36,000
Engineering	15,000
	$414,750

ANNUAL EXPENSE OF MOTIVE-POWER;

Coal	$4,562.50
Engineer and assistant	1,500.00
Firemen (3)	1,800.00
Oiling 2,000 sheaves	4,000.00
Interest on motive plant, 6 per cent. on $414,750	24,885.00
Maintaining wire rope	26,400.00
Maintaining plant, 3 per cent	12,442.50
	$75,590.00

COMPARATIVE SUMMARY.

COST AND MAINTENANCE OF BENTLEY-KNIGHT ELECTRIC, HORSE, AND CABLE RAILWAYS.

ESTIMATE FOR NEWLY CONSTRUCTED LINES.

Cost of horse road	$162,000
" " electric road	344,100
" " cable road	414,750

ANNUAL EXPENSE OF MOTIVE-POWER FOR:

Horse road, table No. 4	$102,960.00
Electric " table No. 1	30,551.50
Cable " table No. 5	75,590.00

ANNUAL SAVING IN COST OF MOTIVE-POWER:

Electricity over horses	$72,408.50
Electricity over cables	45,038.50

The Bentley-Knight Company further offer to construct an electric railway under their system, or to modify an existing horse or cable road to be operated by their system, and will demand no payment for such construction or alteration until a reasonable trial has demonstrated that the electric road possesses all the advantages claimed for it by the company.

Street-Railways in Buenos Ayres.

IN the report of the Municipality of Buenos Ayres for the past year are some interesting figures about street-railways in the Argentine capital, and it is noteworthy that in a total municipal population of about 350,000 people, five street-railways are stated to have carried nearly 23 millions of passengers during the twelve months. The following are the official figures: City of Buenos Ayres Tramway Company, 56 kilometres, 9,954,116 passengers; Anglo-Argentine Tramways, 42 kilometres, 3,-886,444 passengers; Central, 25 kilometres, 4,282,032 passengers; Boca, 13 kilometres, 1,915,859 passengers; Belgrano, 12 kilometres, 2,793,864 passengers; total, 148 kilometres; 22,832,325 passengers. The street-railway traffic of the city of Buenos Ayres engages 1,319 employés, 3,063 horses, and 180 cars.

An Elevated Railway in Paris.

A RECENT number of *Science* has the following: Jules Garnier has designed an elevated railway for the city of Paris, which, it is expected, will be in running order in time for the Exposition of 1889. It will be 28,800 metres (about 18 miles) in length, and will cost $10,000,000. The structure will be composed of two tracks, one above the other, on an iron frame. The whole will be 15 metres from the building line, and vibrations will be guarded against by special appliances. The trains will be composed of three American cars, each 14 metres in length, and two platform or open cars. They will run every five minutes for seventeen hours each day, and will have branches connecting with the several railways.

The Brooklyn and Long Island Cable Road.

THE directors of the Brooklyn and Long Island Cable Company have elected Austin Corbin, president; William Richardson, vice-president; N. H. Frost, treasurer; Chas. Bruff, secretary. Work on the road has been commenced. The structure must be in working order in Atlantic avenue, from South Ferry to Flatbush avenue, by October 1st, 1886, and the cost will be $2,000,000.

Novel Elevated Railway.

CAPTAIN MEIGS is busily at work on his new system of elevated street-railway at his works in Cambridge. The locomotive, which is nearly completed, has the cab in front. The experimental passenger-car is to be of iron and will be pushed in advance of the locomotive. It will be cylindrical in form and about 50 feet long. There will be two lines of windows, one for observation and the other near the top to admit light. There will be two rows of revolving-chars on each side and the car will be ventilated by a new invention. The chief peculiarity of the road and rolling-stock is the use of only one rail with only one center post supporting the structure.

STREET-RAILWAY NOTES.

A STREET-CAR which does not require switch and siding on meeting another car has been contrived. The car is kept on the rails by means of a fifth-wheel in front of the others, and catching in a groove between the rails; the guide-wheel is set in a triangular frame on the fore-axle, and when the driver raises this the car readily leaves the rails, and may be drawn over the street pavement in any direction.

AT a recent meeting of the directors of the National Cable Railway Company in New York, William S. Williams was elected president; Homer A. Nelson, vice-president; Thomas W. Evans, treasurer; A. G. Earle, secretary; and Charles P. Shaw, counsel. The company expect to begin laying their tracks inside of three months. The contracts for the work have already been awarded.

THE Thirty-fourth Street Ferry and Eleventh Avenue Railway Company propose to build tracks in this city from Thirty-fourth Street Ferry, East River, along Thirty-fourth street, Lexington, Park and Eleventh avenues to 106th street with several branches and connections.

THE Union Transit Company, of Chicago, Ill., has been incorporated to construct and maintain a line or lines of elevated railway from such points in Chicago to such points outside the city as the company shall determine upon; capital stock, $5,000,000.

A RAILWAY similar to that on Mount Washington is to be constructed on Mount Royal, at Montreal. The road is to be completed by September, and 18 cents will pay for a round-trip ride from any section of the city and the ascent of the mountain.

AN electric railway and power company has been organized in St. Louis, Mo. The projectors of the enterprise say that they are going to operate an elevated or surface railway by means of electrical transmission of power.

OPPOSITION is so strong in Concord, N. H., to the recent authorized use of steam-motors on the street-railway to Penacook that the courts will probably be appealed to. The reason is that the motors frighten horses.

IN the department of New Inventions of this month's JOURNAL are published descriptions of a metallic cross-tie for elevated and surface roads, and an improved construction of street-railway tracks.

WORK was commenced July 1st on the elevated railway which is to be built between Kansas City and Wyandotte, Kan., about two miles in length, to connect with the new cable railway.

A CHARTER has been granted by the Waterloo, Ia., City Council to J. R. Reynolds, of Boone, to build a street-railway in Waterloo.

THE Suburban Street-Railway Company, of Peoria, Ill., has been incorporated with a capital stock of $15,000.

New Inventions.

Provencal's Car-Coupling.

FRANCOIS V. ISOIRE DIT PROVENCAL, of St. Frederic, Quebec, Canada, is the inventor of a novel form of car-coupling which is herewith illustrated and described. The object of the inventor is to provide a device by which any given car in a train of cars can be coupled or uncoupled from one given point—such as the tender of the engine, the brake-van, or any other point at which the operating-gear is located—and the device consists of a shaft journaled to the under side of the car-floor, and to one side thereof, and provided with a tongue-and-fork coupling, so as to couple automatically into line when the cars are brought together. This shaft is provided with a cam or thumb, set at a different angle on each shaft, and so placed as to lift the coupling-pin, which takes the form of a hook pivoted over and outside the center of the shaft and at right angles thereto. The shaft or line of shafts is operated by a crank and a train of wheels upon the tender, the brake-van, or other suitable point in the train. A device regulating the position of the link is also provided, consisting of a spring lift holding up the projecting end of the link, and a projecting bar on the opposite car engaging the lifter and depressing it to lower the link if demanded by the relative position of the two draw-heads.

In the accompanying cuts, Fig. 1 is a plan of a car-platform with the adjoining tender and part of another car; Fig. 2 an elevation of the same, and Fig. 3 an end view of a car, showing the coupling-pin lifted and the link uncoupled.

A A are car-platforms, and B is the tender. C are the draw-heads, and D the coupling-links, all of the ordinary construction. E are shafts journaled to the under side of the car-floor and near the side of the car, one end having a fork *e*, with flaring mouth, and the other end a flat tongue *e'*, intended to enter the fork *e*, automatically coupling the same rotatively. One of these shafts is placed at each side of the car, so that the ends of cars may be reversed. E' is a cam or thumb placed near each end of each shaft, and each secured to the shaft at a different angle from any other in the same train.

F is the coupling-pin, forming the point of a hook pivoted outside of the shaft E, and over the same and the cam E'. The shaft, which is journaled to the tender, (or to the car or point from which it is intended to operate the same), carries a spur-wheel G, geared by a train of wheels H, to a pinion I, upon the axle of which is secured a hand-crank I'. K is a spring lifting-bar holding up the link, and L is an adjusting-bar on the opposite car secured rigidly, and bent to engage the top of the projecting arm *k*, and to depress it, so as to allow the link to drop into the proper position to enter the approaching draw-head.

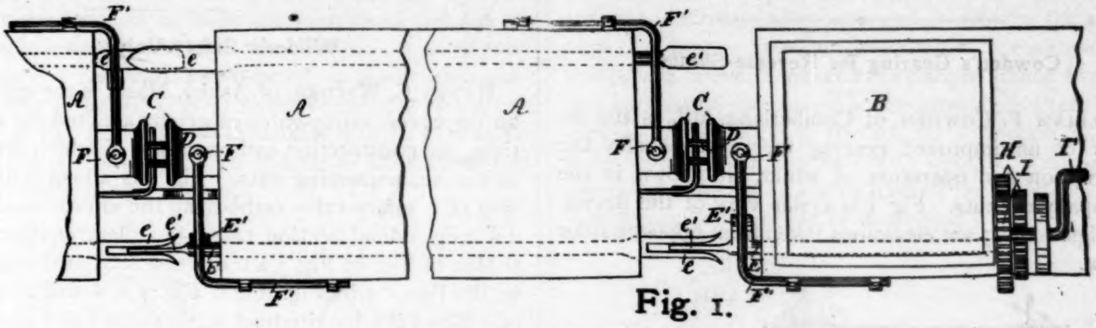


Fig. 1.

PROVENCAL'S CAR-COUPLING.

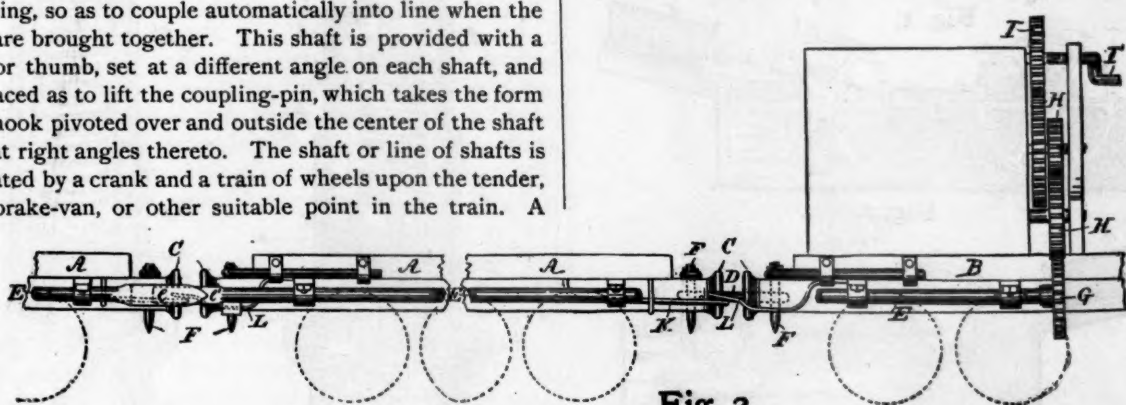


Fig. 2.

PROVENCAL'S CAR-COUPLING.

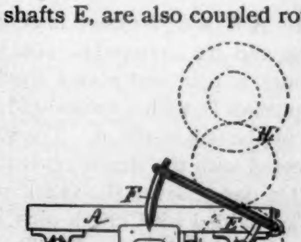


Fig. 3.

PROVENCAL'S CAR-COUPLING

The device operates as follows: All the cars being coupled, the shafts E, are also coupled rotatively, and the entire line of shafts in one train may be rotated by the fireman or other operative by means of the crank I', and in the course of one complete revolution of the line of the

shafts E, all the coupling-pins F, will have been raised and dropped again in succession. When the pin F, is raised, the link is uncoupled and the two corresponding cars may be moved apart.

If any particular car is to be uncoupled, a person will watch the corresponding coupling-pin, and when raised will signal to the person turning the handle I', who, upon receiving the signal, will cease to work the crank, as the car in question is then uncoupled and may be moved off. In coupling it is only necessary to see that the crank is turned into such a position that none of the coupling-pins are raised out of engagement with the link.

Cowden's Gearing for Reverse-Shafts.

WILLIAM F. COWDEN, of Cumberland, Md., is the inventor of an improved gearing for reverse-shafts the construction and operation of which are shown in the accompanying cuts. Fig. 1 is a plan view of the device, and Figs. 2 and 3 are elevations taken from opposite sides thereof.

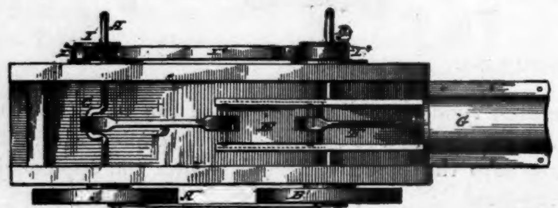


Fig. 1.

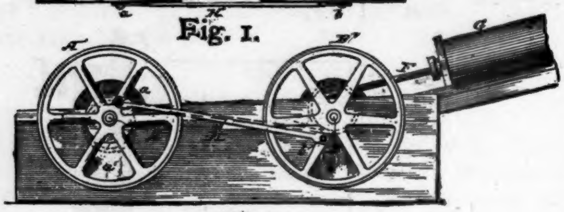


Fig. 2.

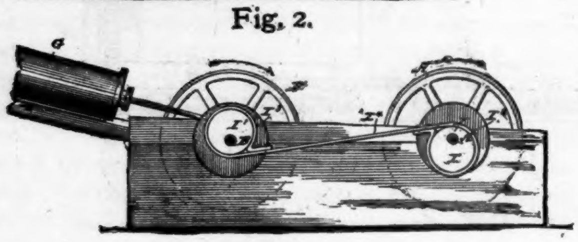


Fig. 3.

COWDEN'S GEARING FOR REVERSE-SHAFTS.

Two twin shafts A B, are journaled in suitable bearings in the main frame, and are arranged parallel to each other. One of these shafts is provided with a crank C, which is connected by a pitman D, with a cross-head E, connected with and driven by the piston-rod F. The steam-cylinder G, may be connected with the steam-generator in any desired manner. On one end the shafts are provided with fly-wheels A' B', provided with crank-pins *a b*, and, preferably, with counterpoise-blocks *a' b'*. The pins *a b*, are connected by a connecting-pitman H, which is so arranged as shown, that the shafts will be revolved in opposite or reverse directions. The motions of the shafts are steadied by the fly-wheels and the added counterpoises.

On the shafts A B, and in line with each other, are fixed eccentric disks I I', arranged with their longest radii at an angle (approximately a right angle) to the crank-pins *a b*, on their respective shafts. The rings I^2 I^3, of these eccentrics are connnected by a strap I^4. By these eccentrics the cranks will be kept off the dead-center, and they operate to give uniformity to the movement of the machinery.

By this improvement a high rate of speed may be attained, and the machinery will run easily and smoothly. The constructions are light, not liable to get out of repair, and can be quickly and cheaply repaired when necessary.

The device is especially adapted for driving the shafts of twin propellers, but it can also be employed to serve a nnmber of other useful purposes.

Wilder's Safety-Valve.

HENRY C. WILDER, of Ashby, Mass., is the inventor of an improved safety-valve especially adapted for locomotives, the construction and operation of which are shown in the accompanying cuts. Fig. 1 is a longitudinal section of a safety-valve embodying the improvement; Fig. 2 a longitudinal section taken in a plane at right angles to that of Fig. 1; Fig. 3 a transverse section thereof taken on the line *x x* in Fig. 1, and Fig. 4 a detail view thereof. Fig. 5 is a longitudinal section of a valve, showing a modification; Fig. 6 a sectional detail view of the modification, and Fig. 7 another sectional detail view of the same.

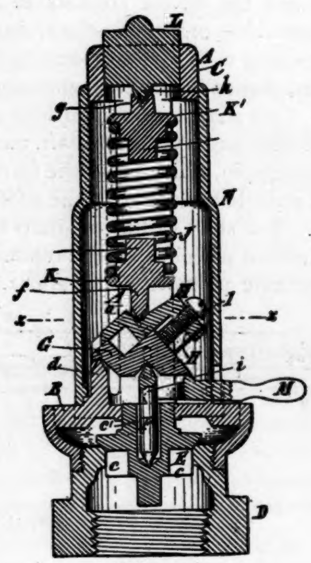


Fig. 1.

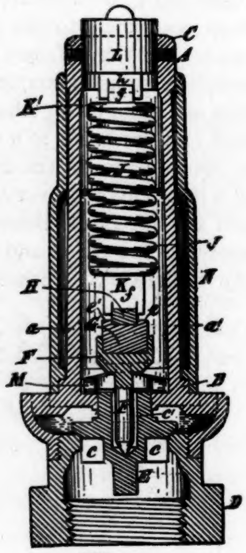


Fig. 2.

WILDER'S SAFETY-VALVE.

A is the frame of the valve by which the various parts are supported. As shown, it consists of two arm-like portions *a a'*, fastened upon a base-piece B, and bearing at their ends a cylindrical rim-like portion C. These arm-like portions, the base-piece, and the ring-like portion are preferably made integral. The base-piece B, is of circular form and hollow. It extends for a considerable distance laterally beyond the arm-like portions *a a'*. This is to afford provision for the escape of steam through apertures *b*, in the upper portion of the base-piece B. A coupling-piece D, is adapted to be screwed into the lower portion of the base-piece B, this coupling-piece being adapted to be secured in any suitable manner to a steam-boiler. Near its upper end the coupling-piece constitutes

a valve-seat for a valve E. Guides *c*, on the valve E guide the valve in its movements. A recess in a projection *c'*, in the upper portion of the valve is adapted to receive one end of a pin F. The valve is further guided in its movements by the projection *c*, which is adapted to move through an aperture in the upper p rtion of the base-piece B. As shown, the outwardly-extending end of the pin F, is bifurcated.

G is a lever fulcrumed near one end upon a fulcrum-piece *d*, forming part of the frame A. About midway in its length the lever G, is recessed upon its under side to receive the bifurcated end of the pin F. It will be seen that when the valve E, is raised from its seat, it operates to move the lever G, through the medium of the pin F. H is an adjustable section of the lever G. It is adapted to be moved backward and forward upon the upper surface of the lever G. Owing to the contour of the upper surface of the lever G, the adjustable section H, may be moved thereon in a direction oblique to the direction of the movement of the valve.

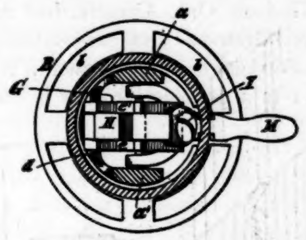


Fig. 3.

Fig. 4.

WILDER'S SAFETY-VALVE.

A set-screw I, engaging with one end of the adjustable section H, and bearing at its free end upon the main section of the lever G, may be adjusted to vary the position of the adjustable section H, upon the main section of the lever G. Guides *e e'*, on the main section of the lever G, guide the adjustable section H, in its movements.

J is a spring, shown as helical, arranged between the arm-like portions *a a'*, of the frame A. Bearing-pieces K K', are arranged one upon each end of the spring J. The bearing-piece K, is provided with a projection *f*, upon its lower side. Such projection is preferably knife-edged at its lower extremity, and is adapted to bear upon the upper surface of the adjustable section H, of the lever G. The bearing-piece K', is provided upon its upper surface with a projection *g*, adapted to receive a knife-edged projection *h*, upon the inner end of a cylindrical plug L, fitting within the rim-like portion C, of the frame A, and secured therein by screws or otherwise. The plug L, may be adjusted inwardly and outwardly to vary the resistance of the spring J. The knife-edge may be arranged upon the bearing-piece and the projection which receives it upon the plug, if desirable.

The lever G is combined with a device whereby the valve may be opened at pleasure. This device, as shown, consists of a lever M, having a bifurcated end extending between the arm-like portions *a a'*, of the frame A. The bifurcated arms of the lever pass one upon each side of the pin F, and so as not to interfere with the rising of the valve. A projection or rib *i*, upon the upper surface of the lever M, is shown for acting against the lever G. By manipulating the lever M, the valve E, may be raised from its seat. N is a cylindrical case or shell adapted to inclose the parts. It may be moved on and off longitudinally at pleasure.

Steam entering the coupling-piece D, operates to raise the valve E, from its seat. Force is thereupon exerted upon the lever G, by means of the pin F, which force the spring J, has a tendency to counteract. As the lever G, is raised, however, it operates to oscillate the spring J, in one direction, thus shifting the point upon the lever where the resistance of the spring is exerted, and moving such point of resistance more and more out of the line of application of force exerted by the escaping steam. By this arrangement the tendency of the resistance of a spring to increase, when arranged to receive the application of a force exerted to overcome such resistance in a direct line, is overcome, and the danger arising from sudden and undue increase of boiler-pressure is averted. By varying the position of the adjustable section H, of the lever G, the valve may be set to operate at any desired steam-pressure, as by such variation the resistance of the spring may be increased or decreased.

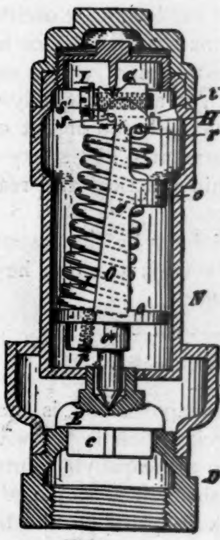


Fig. 5.

Fig. 6.

Fig. 7.

WILDER'S SAFETY-VALVE.

In the modification shown in Figs. 5, 6, and 7 the frame A, as shown in Figs. 1, 2 and 3, is not needed, and for this reason the shell N, and the base-piece B, are preferably made integral. O is a frame having a circular base portion *o*, and arm-like portions *o'*. A semi-circular connecting-piece o^2, extends between the arm-like portions *o'*, but this may be omitted. In this modification the pin F, is preferably made integral with the frame O. A projection o^3, upon the under side of the circular base portion *o*, of the frame, serves to raise the base portion somewhat above the bottom of the case or shell N.

The spring J, is arranged within the frame O. The lower end of the spring rests upon a bearing-piece K. A screw *p*, passing through a screw-threaded aperture in the projection o^3, on the base portion *o*, is affixed to the bearing-piece K. A bearing-piece K', is arranged upon the opposite end of the spring J. This bearing-piece has a knife-edged projection upon its upper surface adapted to bear upon the adjustable section H, arranged beneath and adapted to be moved backward and forward within guides

upon the lever G. The lever G, is fulcrumed at *r*, upon downwardly-extending parts of the arm-like portions *o'*, of the frame O. Pins or projections *s*, on the lever G, are adapted to abut against projections *s'*, near the upper end of the arm-like portions *o'*, and prevent the lever G, from moving as far in one direction as it would otherwise do.

The set-screw I, has upon it a circumferential rim adapted to engage with a slot in the adjustable section H, of the lever G, whereby, when the screw is turned, it will carry the adjustable section with it in its forward and backward movement. A stop *t*, on the adjustable section H, prevents too great an extended movement in one direction. The knife-edged projection upon the cylindrical plug L, bears upon the upper surface of the lever G. By adjusting the screw *p*, inwardly or outwardly, the resistance of the spring J, may be varied.

The operation of this modification is that of toggle-levers, of which the frame O, constitutes one lever, and the lever G, the other. When pressure is exerted upon the valve it operates to raise the frame or lever O. The lever G, is then caused to be moved against the resistance of the spring J, the result being that the levers are oscillated.

It is claimed by the inventor that his device is simple in construction and easy of adjustment, and is especially adapted for use on locomotives as a gradually-opening safety-valve requiring the manipulation of but one part only, and no secondary adjustment. The safety-valve is also claimed to operate, within practical and reasonable limits, to any desired pressure.

The device is controlled jointly by the inventor and Joel G. Willard, of New York City, to whom he has assigned one-half the patent-rights.

Miller's Nut-Lock.

FRANK L. MILLER, of Indianapolis, Ind., is the inventor of a new form of nut-lock, which is herewith illustrated and described. In the accompanying cuts, Fig. 1 is a view of a bolt passing through a couple of boards with a nut, and the nut-lock in place on the bolt, the boards and nut being in cross-section; Fig. 2 an end view showing the lock entered upon the thread of the bolt, and Fig. 3 a front view showing the shape of the lock as stamped from the sheet of steel.

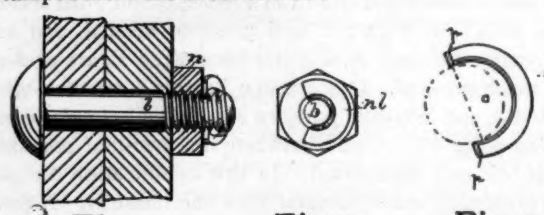


Fig. 1. Fig. 2. Fig. 3.

MILLER'S NUT-LOCK.

In detail, *nl* is the lock-piece, and is made from a piece of sheet steel, one arm a little longer than the other, the opening O, being cut in horseshoe shape, so that the points *p*, are drawn in slightly toward each other. *b* is the bolt, and *n* is the nut. When the nut has been screwed up as tight as desired, the lock-piece is driven down in front of the nut astride the bolt in such a manner that one arm of the lock-piece presses closely against the turning-off side of the nut, and in a manner wedges it down, while the other arm of the lock-piece is at the distance of one thread's width from the other side of the nut. The wedged arm prevents the nut from turning off or getting loose, while the other arm of the lock-piece, being free from contact with the nut, is not liable to be carried round on the thread by any movement of the nut.

The nut and lock-piece are shown in proper relative position in Fig. 2. The longer arm of the lock-piece is the one which should bear against the nut, as it gives a longer bearing in the thread of the bolt. It will be found that when the points of the lock-piece pass the center of the bolt they will spring toward each other, thus holding the lock-piece firmly in place.

The device is claimed to be simple, reliable and inexpensive. It is now controlled by the inventor and Glenwood Preble, of Indianapolis, to whom one-half the patent rights has been assigned.

Raper's Draw-Bar and Coupling.

WILLIAM RAPER, of Windsor, Ont., Canada, has recently invented an improved draw-bar and car-coupling, the construction and operation of which are shown in the accompanying cuts. Fig. 1 is a perspective view of the

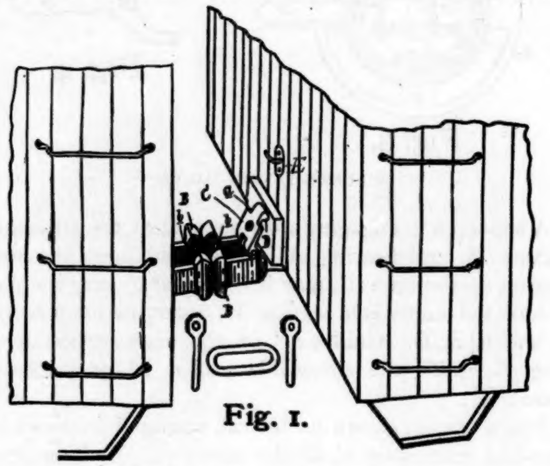


Fig. 1.

RAPER'S DRAW-BAR AND COUPLING.

improved car-coupling attached to two freight-cars ready to be coupled together; Fig. 2 a vertical central section through the car-coupling, one draw-head having its hinged cover opened and the coupling-pin removed; Fig. 3 a side view of one draw-head, and Fig. 4 a plan thereof.

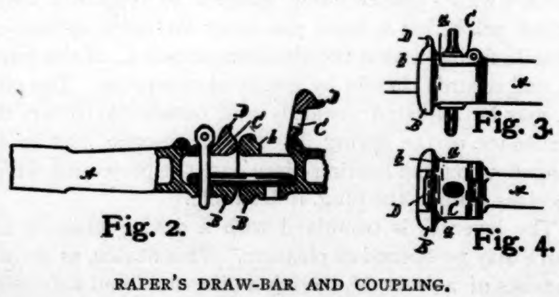


Fig. 2. Fig. 3. Fig. 4.

RAPER'S DRAW-BAR AND COUPLING.

A is the draw-bar of an ordinary link-and-pin coupler, provided with a draw-head B, of the ordinary construction, except that its top side C, does not form an integral part of the draw-head, but forms a separate piece, which is hinged at its rear end to the body of the draw-head so as to form a hinged lid thereto, which, when opened, gives

free access to the recess in the draw-head. The hinged top C, has formed on it near its free end the shoulders or offsets *a*, which, when the top is closed, impinge against the solid portions *b* of the draw-head. D is a lip formed near the free end of the hinged top. It forms a convenient handle with which the operator may open the hinged top. E is a hook attached to the face of the car in which the link is to be hung when not coupled.

In practice the operation of coupling cars with this coupling may be proceeded with in the same manner as with the common link-and-pin coupling in ordinary use; but it may also be performed in a manner entirely different which excludes all liability of accidents and saves time.

It is well known that in making up a freight-train composed of cars provided with the ordinary link-and-pin coupling the cars have to be assembled and coupled one by one, by the use of an engine, and no coupling can be made between stationary cars. With this coupler a coupling can be effected between stationary cars without the use of an engine.

To make up a train where the cars are provided with this device, the pins and links are first removed from the the draw-heads, then the cars are assembled or backed up against each other. The further use of the engine is now dispensed with, and for greater safety it may be moved some distance away. While the cars are now in this stationary position with the draw-heads impinging against each other, the brakeman enters between the cars, opens the lids of the draw-heads, drops a link in the recesses of the two draw-heads, closes the lid again and inserts the pins. Thus all the cars are coupled together, and the time required is greatly less than with the ordinary coupler, while the danger is entirely removed. This mode of coupling can even be performed where but one of the two draw-heads has the removable lid, as the link can be easily inserted endwise into the other draw-head.

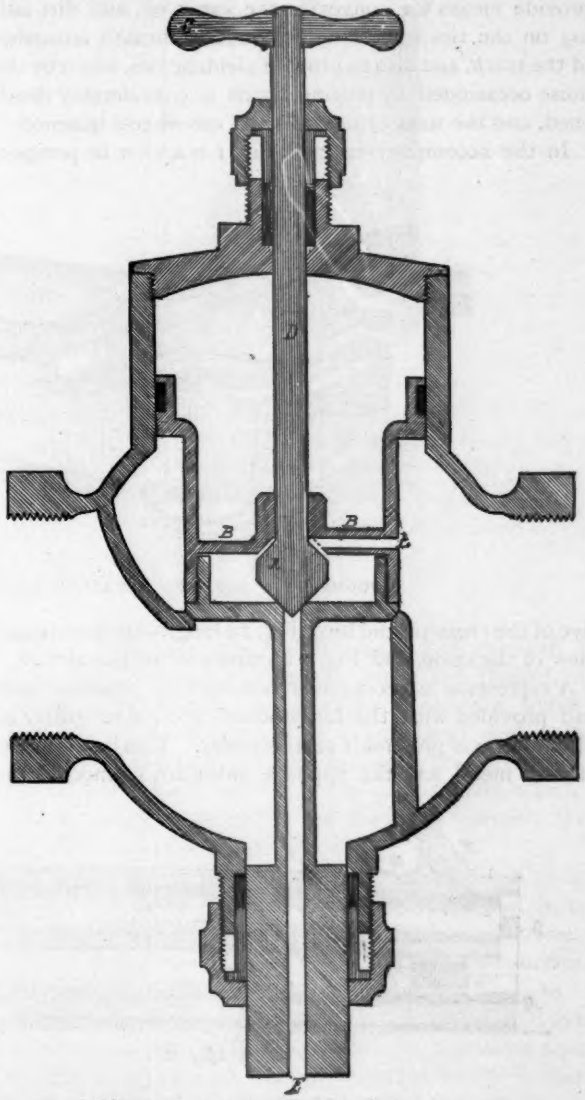
It will be seen that the strain in hauling does not come upon the hinge, but is taken up by the offsets or shoulders *a*, and the lid when closed is firmly seated against any other displacement, except in the direction in which it opens, and which is resisted by its own weight and the weight of the pin.

Haskell & Fleming's Anti-Pressure Valve.

CHARLES S. HASKELL and WILLIAM B. FLEMING, of Philadelphia, Pa., are the inventors of an improved anti-pressure steam and water valve, the construction and operation of which are shown in the accompanying cut, which represents a sectional view of the valve.

C is the handle, and D the stem, B B the main valve, and A A the secondary valve. To close the valve the handle C, is pressed down, thus closing the secondary valve and gradually bringing the full pressure to bear upon the upper side of the main valve as it closes. To open the valve the handle C, is raised, opening the secondary valve and gradually taking the pressure from the top of the main valve until the friction only remains to be overcome.

The operation of the device is as follows: In the position shown, the pressure entering by the pipe P, passes through the passage E, past the auxiliary valve; thence through the passage into the chamber above the main valve, thereby seating the main valve firmly and closing the same. If the handle C, be raised, the opening, E will be closed and the opening F will be opened. Therefore the water above the main valve will flow downward and escape through the opening F, and the pressure acting beneath the main valve and in the annular space around will raise the same in the chamber above it. It will be observed that the upper part of the main valve is larger than the seating portion below. It is obvious that the valve should be suitably packed and provided with suitable seats, as is shown in the accompanying cut.



HASKELL & FLEMING'S ANTI-PRESSURE VALVE.

The inventors have also designed an attachment to the device, by which it can be operated entirely by electricity, thus enabling it to be controlled from a distance. By this attachment the device can be made to serve a number of useful purposes.

It is claimed for the device that it operates with the pressure and not against it; that it is perfectly balanced, because the pressure is removed and gradually equalized in its first movement, by means of a small secondary valve inside and forming part of the main valve; that it is an

absolute cut-off, since, in closing the pressure is brought gradually upon the top of the valve until the full steam or water-pressure is exerted to keep it closed, and that it can be operated by a child, even the largest sizes, without the intervention of machinery.

Dougherty & Bryant's Metallic Cross-Tie for Elevated and Surface Railways.

EDWARD D. DOUGHERTY and GEORGE B. BRYANT, of Philadelphia, Pa., are the inventors of a metallic cross-tie for elevated and surface railways, which is herewith illustrated and described. The object of the inventors is to provide means for conveying the water, oil, and dirt falling on the ties into suitable conduits located alongside of the track, and also to provide yielding ties, whereby the noise occasioned by passing trains is considerably deadened, and the wear of the rails and car-wheels lessened.

In the accompanying cuts, Fig. 1 is a view in perspective of the cross-tie and box; Fig. 2 a longitudinal sectional view of the same, and Fig. 3 a transverse sectional view.

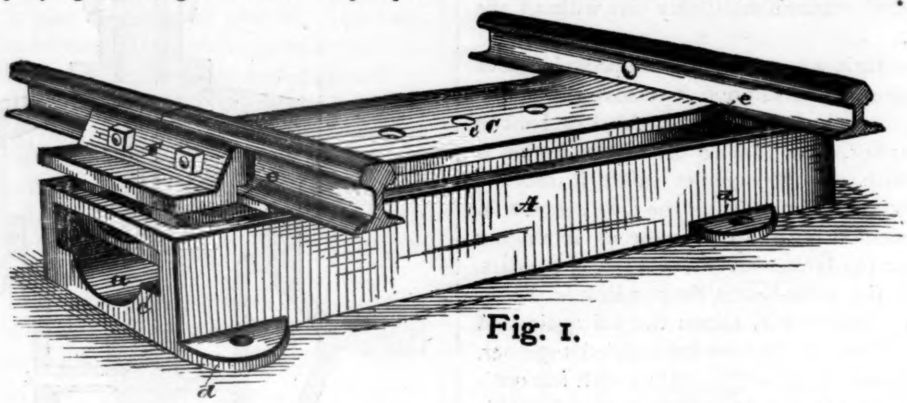


Fig. 1.

DOUGHERTY & BRYANT'S METALLIC CROSS-TIE FOR ELEVATED AND SURFACE RAILWAYS.

A represents a rectangular box open at opposite ends and provided with the longitudinal groove or gutter *a*, which latter is preferably semi-circular. This box is made of cast metal, and the opposite sides are connected together at their upper ends by the ribs or braces *b*. The bottom of the box is provided with the lugs *c*, which latter are arranged to prevent the lateral displacement of the semi-elliptic springs B, on which the cross-tie C, rests. The springs are slightly shorter than the width of the box to enable them to expand freely, and when in position in the box rest under the rails, so as to take the entire weight of the passing train. The groove or gutter in the bottom of the box is under the springs, and hence the latter do not obstruct the gutter.

The boxes A, when employed on surface roads are embedded in the earth, while on elevated roads they are secured to the girders by means of the laterally-projecting lugs *d*, cast integral with the boxes. The cross-ties C, are also preferably made of cast metal, and are hollow and provided on their upper surfaces with transverse grooves *e*, in which the rails rest, and with the upwardly-projecting flanges F, which conform to the web of the rails and serve as fish-plates. The ties are adapted to rest on the semi-elliptic springs B, and move vertically within the box, and the upper surface thereof between the grooves for the rails are concaved so as to direct the water and oil falling thereon toward the longitudinal center of the ties, from which it passess through the perforations *e'*, in the upper and lower faces of the ties into the grooves in the box A. These grooves can incline slightly toward one side, so as to convey the water into a spout or conduit located alongside of the track. The ties C, are placed in position on the springs, (which instead of being semi-elliptic, can be of any other shape, and instead of being of metal can be made of rubber), and hence it will be seen that as a train passes over the same, the tie yields to the weight thereof, and consequently the noise produced by a train passing over a solid, unyielding structure is obviated. Again, by causing the tie to yield, the sudden shocks and jars occasioned by a heavy weight passing over a solid foundation is overcome, and the cars pass over the yielding ties with an easy motion. If, from any cause, the springs should break, the ties drop on the lugs *c*, which are cast on the bottom of the box A, and are held securely in position. By simply elevating the tie with a bar or lever, the spring can be replaced without stopping travel and without removing any of the parts.

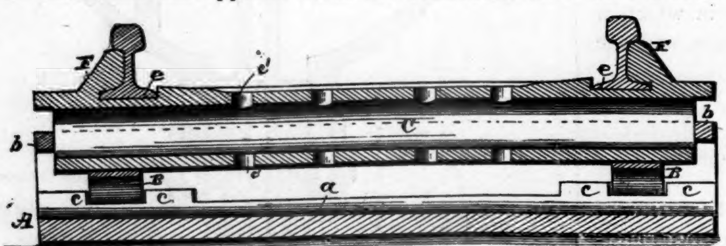


Fig. 2.

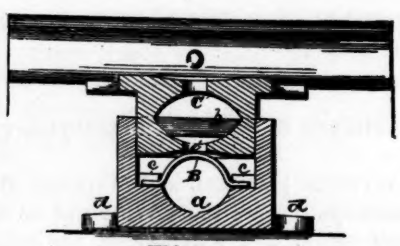


Fig. 3.

DOUGHERTY & BRYANT'S METALLIC CROSS-TIE FOR ELEVATED AND SURFACE RAILWAYS.

It is claimed by the inventors that the use of this device avoids injury to the rolling-stock, does away with the use of fish-plates, saves time and labor in taking up and adjusting defective spikes, prevents spreading of rails, and effects a saving in time. The device is also claimed to be both economical and durable.

Wells' Oiler.

EDGAR J. WELLS, of Ticonderoga, N. Y., is the inventor of an oiler for mechanical uses, which is herewith illustrated and described. In the accompanying cuts, Fig. 1 is a vertical sectional view of an oiler embodying the invention, and Fig. 2 a side elevation of the same.

A represents a cup or reservoir for the oil, which is provided at its lower end with a threaded projection *a*, to adapt the cup to be secured to a steam-cylinder, steam-chest, or any other mechanism to be lubricated. B is the oil-feeder, which has its lower end tapered and ground into an opening made to receive it in the lower end of the oil-cup. This oil-feeder has a vertical extending

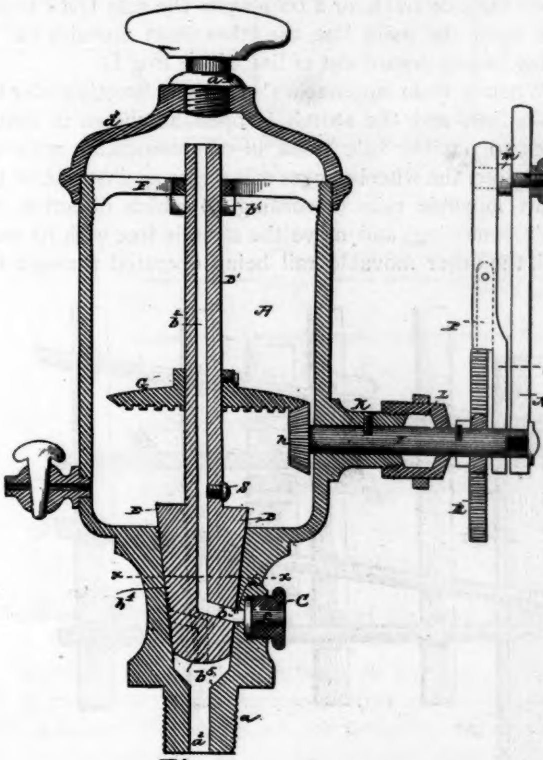


Fig. 1.

WELLS' OILER.

hollow shaft B′, the upper end of which bears in a spider F, that is screwed into the upper side of the oil-cup. A collar b', is made near the upper end of the shaft B′, and bears under the spider F. The central opening b^2, which extends down through the shaft *b*, connects with an oblique opening b^3, which extends out to one side of the oil-feeder, near the lower end thereof, and communicates with an opening a', which is made in one side of the oil-cup, near its lower end. C is a bushing which is screwed into an opening formed in the oil-cup, and this bushing is provided with a central opening *c*, which communicates with the opening a'. a^2 is the central opening, which is made in the lower end of the oil-cup and communicates with an opening b^5. S is a screw which passes through an opening that communicates with the central opening b^2, in the shaft B′, near the lower end thereof. b^5 is an opening which extends from the lower side of the center of the oil-feeder B, up to the side thereof, on a horizontal line with and nearly opposite to the lower end of the opening b^3, so that when the oil-feeder revolves, the openings b^3 and b^5 will alternately communicate with the opening a'. The upper end of the oil-cup is provided with a cover a^3, which is screwed on the upper side of the oil-cup, and is provided at its center with a screw-plug a^4, by means of which the oil is introduced into the oil-cup.

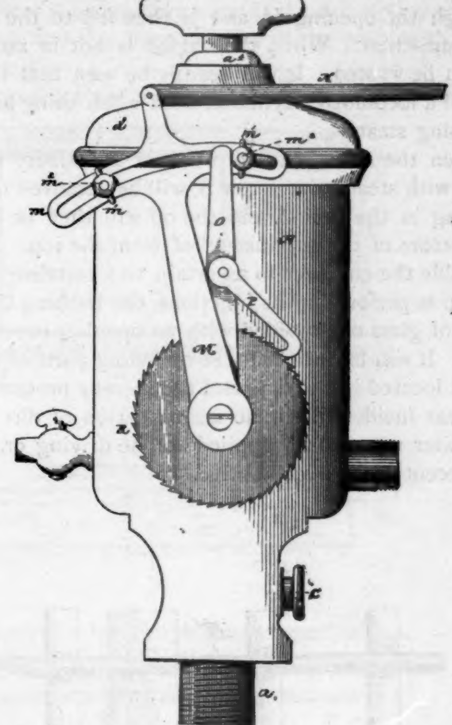


Fig. 2.

WELLS' OILER.

G is a bevel gear-wheel which is fixed to the shaft B′, at a suitable distance from the lower end thereof, and with this gear-wheel G, meshes a bevel-pinion *h*, which is attached to the inner end of a horizontal shaft I, that extends out through a bearing-sleeve K, that is formed in one side of the oil-cup. L is the packing-box, which is screwed on the outer end of the sleeve K, to prevent leakage of oil or steam around the shaft I.

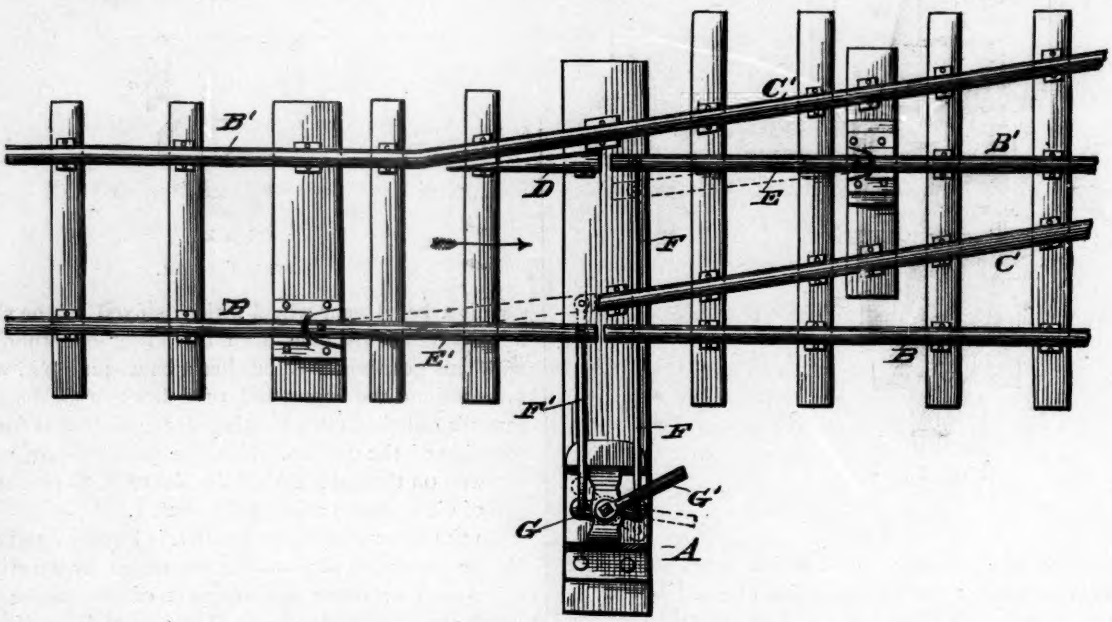
To the outer end of the shaft I, is loosely fixed an arm M, the upper end of which is connected by a rod N, to a valve-stem or other suitable part of the mechanism to which the oiler is attached. The arm M, is provided near its upper end with a slotted quadrant *m*.

O is an arm which is loosely secured to the shaft I, adjacent to the arm M, and to this arm O, is pivoted a pawl P, that is adapted to engage a ratchet-wheel R, that is fixed to the shaft I. The upper end of the arm O, bears against the inner face of the quadrant *m*, and this quadrant is provided with blocks m', which are secured by means of thumb-screws m^2, by which means the blocks m', may be moved nearer together or farther apart, so as to regulate the throw of the arm O, and thereby regulate the quanity of oil that is fed from the oil-cup. By means of this construction it will be readily understood that as the rod N, reciprocates, a rotary motion is imparted to the oil-feeder.

When the oiler is to be used on a locomotive, connection must be made with the pipes running from the cup to the nipple on the oiler. This connection being made,

the steam let on to the cup through the pipes will condense and the pressure will cause the water to float the oil to the top of the cup, and thence down through the opening b^2, and as the opening b^3, registers with the opening c, the opening c, is filled with oil. When the opening b^5, communicates with the opening c, as the oil-feeder rotates, the oil in the opening c, passes down through the opening b^5, and is then fed to the cylinder or steam-chest. When the engine is not in motion, no oil can be wasted. It will readily be seen that this oiler will oil a locomotive-cylinder, both when using and when not using steam.

When the oiler is to be used for machinery not provided with steam, the screw S, will be removed from the opening in the shaft b, and the oil will then be fed from the bottom of the cup instead of from the top. In order to enable the engineer to ascertain to a certainty that the oil-cup is performing its functions, the bushing C, will be made of glass or provided with an opening covered with glass. It will be seen that the operating parts of the oiler are all located in the cup, and are thereby protected from the wear incidental to the accumulation of dirt or grit. This oiler can also be applied to the driving crank-pins and eccentrics of a locomotive.



PURVIANCE'S AUTOMATIC RAILWAY SWITCH.

Purviance's Automatic Railway Switch.

BENJAMIN F. PURVIANCE, of Keokuk, Iowa, is the inventor of an automatic railway switch, which is herewith illustrated and described. The accompanying cut is a top plan view of the switch.

A represents the switch-stand, and B B' the stationary rails of the main line, the rail B', of the same being bent or curved outward at a point a little in advance of the switch-stand, where it connects with the outer rail C', of the side track. At the point where the main rail B', is thus curved outward, is placed a frog D, of ordinary construction, this frog being secured in such a position, as shown, that when a train is passing over the main line the wheels on that side of the line will pass from the main line over the frog and thence upon the main line again when the short movable rails are in the position shown. E E' indicate the short movable rails which form a part of the main-line rails B and B', and are arranged diagonally opposite each other as shown, the free ends of these movable short rails being connected by the draw-bars F F', to the two ends of the bell-crank G, secured upon the switch-stand A, and provided with the operating-handle G'.

When the bell-crank is turned by the operating-handle of the same into the position shown in dotted lines, it will operate to move the short movable rails in reverse directions, the left-hand movable rail E', being thrown in line with the inner rail of the side track, thereby enabling a train approaching in the direction of the arrow to run upon the side track, or a train from the side track to run out upon the main line, the other short movable rail E, being swung inward out of line of the frog D.

When a train approaches in either direction over the main line, and the switch is open, as shown in dotted lines, to put the side track in communication with the main line, the wheel-flanges will strike against one of the short movable rails (according to which direction the train is moving) and move the same in line with its main rail, the other movable rail being operated through the bell-crank and draw-bars by the movable rail to swing it automatically in line with its respective main-line track, the movable rails being of such short length that there will be no difficulty in their being operated by the locomotive.

When the movable rails are swung in line with the rails of the side track and it is desired to have the train pass from the main line off upon the side track, it is, of course, necessary for the switchman to retain hold of the operating-handle or lever G', thereby holding the movable rails in this position, and preventing the wheels of the locomotive from automatically closing the side tracks by throwing the movable rails in line with the main rails, as before described.

It will be seen that it is impossible for the train to run off upon the side track (unless the switch is deliberately

held for that especial purpose) or into the open switch, as the train itself operates automatically to bring the movable rails in line with the main rails no matter from which direction the train may be approaching over the main-line tracks.

It is claimed for this device that it is peculiarly simple in construction, devoid of complicated mechanism, and not liable to breakage or derangement.

The device is now controlled by the inventor and C. Hills, of Keokuk, Iowa, to whom one-half the patent-rights has been assigned.

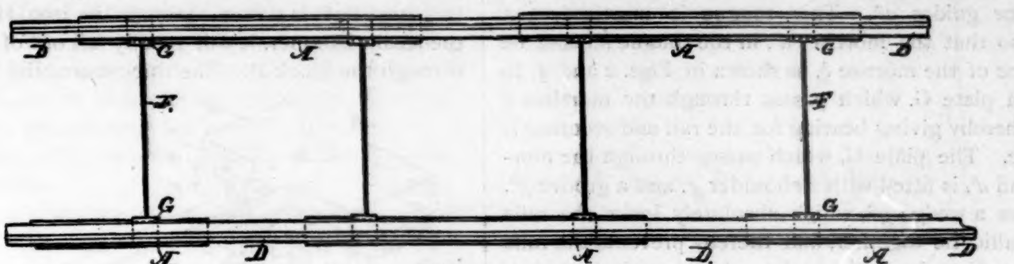


Fig. 1.

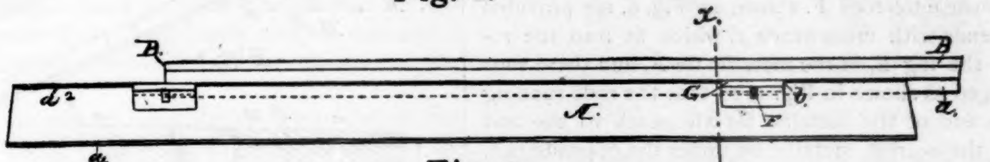


Fig. 2.

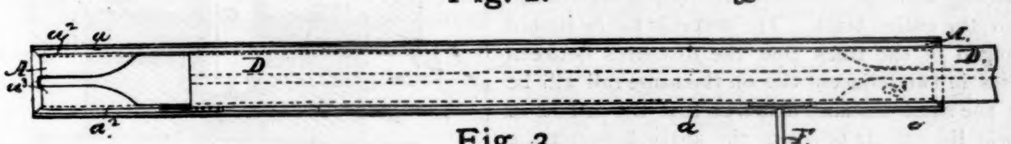


Fig. 3.

GIBBON'S IMPROVED CONSTRUCTION OF RAILWAY TRACKS.

Gibbon's Improved Construction of Railway Tracks.

THOMAS H. GIBBON, of Albany, N. Y., is the inventor of an improvement in the construction of railway tracks, which is herewith illustrated and described. The object of the invention is to provide suitable appliances for building steam or street-railway tracks in a permanent and substantial manner, to prevent the spreading and creeping of track, allowing the rails to expand and contract, and to dispense with the use of wooden ties, longitudinal stringers, nails, bolts, and spikes; and it consists of a metallic tie and combination, a series of which form the bed for the rails, the metallic tie being arranged in the track so that the center of each tie will be immediately opposite the space between the ends of the two adjacent ties in the opposite track. A transverse tie-rod runs from each end of the tie, and each of these rods connects with the nearest end of the opposite located tie at right angles in such a manner that each tie will be connected with two adjacent ties of the opposite track. A transverse tie-rod is fixed at each end, so as to extend at right angles therefrom, and is secured to the opposite metallic tie at its nearest end. By this means the two tracks are connected together by a system of bracing, and when laid as above described the metallic tie is filled and surrounded with the ballast, and when running through cities the track is paved in the usual manner.

In the accompanying cuts, Fig. 1 is a plan view of a railway track embodying the invention; Fig. 2 an enlarged side elevation of the metallic sleeper and rail combination; Fig. 3 a plan view of the same; Fig. 4 a transverse section through the metallic tie and rail combination at the line $x\,x$ of Fig. 2 on an enlarged scale; Fig. 5 an enlarged perspective end view of the metallic sleeper with the rail removed; Fig. 6 a perspective view of the transverse tie-rod; Fig. 7 a perspective view of the rail with the tongue mortised, and Fig. 8 a plan view of the plate with groove and shoulder.

A represents the metallic tie, which consists of an oblong metallic box opened at the top and bottom or perforated, its sides and ends inclined inwardly and upwardly so as to produce a large bearing-surface for its base.

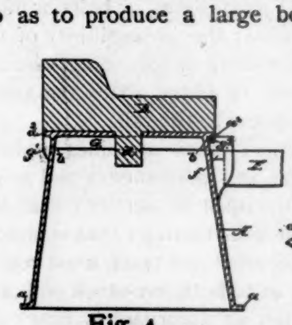


Fig. 4.

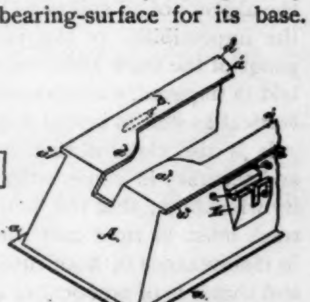


Fig. 5.

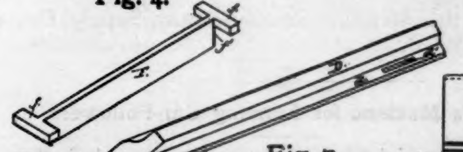


Fig. 6. Fig. 7.

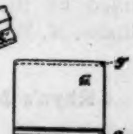


Fig. 8.

GIBBON'S IMPROVED CONSTRUCTION OF RAILWAY TRACKS.

Around the lower edge of the box, externally-projecting flanges a, may be formed, and also on the upper edge of the box are internally and externally projecting flanges a' and a^2, and at each end of it are internally-projecting flanges or guides a^3, formed on each side near each end of the box, as shown in Fig. 5. These flanges or guides

are adapted to receive the tongue *d*, which runs along the entire length of the rail D, thus affording greater strength and true alignment to the rail. The metallic box is provided with two mortises *b*, immediately under the flange *a'*, on each side, near the end, and directly in line with the center line of each mortise *b*. A lug E, with recesses *e* and *e'*, or its equivalent, may be formed to secure the head *f*, and shoulder *f'*, on each end of the transverse tie-rod F. A recess is formed at each end of the box to receive the tongue *d*, of the rail D. The rail D, is provided with a tongue *d*, which is fitted to lie between the flanges or guides a^3. This tongue is mortised, and located so that the mortises *d'*, in the tongue *d*, shall be in the line of the mortise *b*, as shown in Figs. 2 and 5, to receive a plate G, which passes through the mortises *b* and *d'*, thereby giving bearing for the rail and securing it to the tie. The plate G, which passes through the mortises *b* and *d'*, is fitted with a shoulder *g*, and a groove *g'*, to receive a wedge g^2, which absolutely locks the rails and metallic tie together, and thereby prevents the rails from becoming loose from lateral or vertical strains. The transverse tie-rods F, shown in Fig. 6, are provided at both ends with cross-heads *f*, which fit into the recesses of the lug E, in the metallic tie A, and these rods are arranged as shown in Fig. 1, so that the rods running from one end of the metallic tie will reach to the end recess of the nearest metallic tie under the opposite rail, and this arrangement of transverse tie-rods is maintained throughout the entire track. The metallic tie A, should be so arranged in the track that the distances between the mortises in two adjacent ties on the same rail will be spaced at the same distance apart, so that the middle of each tie will lie exactly opposite the space between the ends of the two adjacent ties of the opposite track, as shown in Fig. 1.

It is claimed for this system of construction that it insures the absence of all perishable material, like timber; the absence of all spikes and joint-plates, or bolts or nuts; the impossibility of low joints; the impossibility of the gauge of the track either narrowing or spreading, whether laid in unpaved, macadamized or paved roadways, and a vertical as well as lateral stiffness to the rail.

It is also claimed that this system combines rapidity and accuracy in construction, and permanency and solidity when laid; that the joints must be perfect; that the track must be rigid and smooth-running; that economy in maintenance of both equipment and track must result, and that it is of practical value to both live-stock and cars.

The improved construction as described is now controlled by the Metallic Street-Railway Supply Co., of Albany, N. Y.

Rhyn's Machine for Forming Car-Followers.

HENRY RHYN, of Cincinnati, O., has recently invented a machine for forming car-followers. Heretofore followers have been first formed with one device and then punched with another; thus in using two devices it requires two operations. With this machine the forming and punching is done in one operation, and is accomplished with only three parts, viz: an upper block, a lower block and a pin-punch.

In the accompanying cuts, Fig. 1 is a perspective view of the entire machine, and Fig. 2 a sectional view of the upper block A, lower block B, pin-punch C, and iron H. The form of the lower block B, and position of its hole *b*, is exactly the same as the form and the position of the hole in the required follower to be formed and punched. The hole *b*, is tapered, as shown in Fig. 2, to give ready passage for the punching *h*, through it.

The upper block A, has flanges *a' a'*, which serve as cutting-edges. The inner sides of these edges closely fit the lower block B, and a straight hole (not tapering) directly in line and above the hole *b*, in the block B. The pin-punch C, is larger at the punching end *c*, so that when this large end is driven through the iron H, by blows of the steam-hammer, it will readily fall out of the iron and through the block B. The thickness of the blocks A and

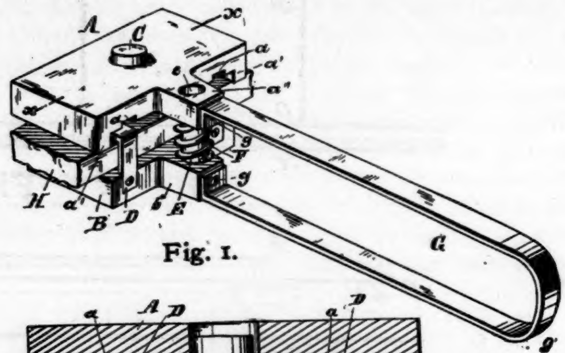


Fig. 1.

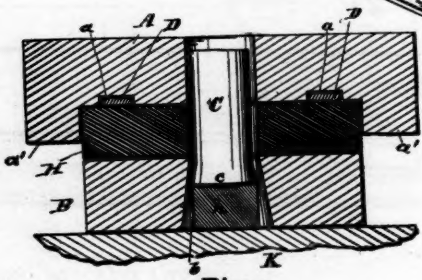


Fig. 2.

RHYN'S MACHINE FOR FORMING CAR-FOLLOWERS.

B, and the depth of the flanges *a' a'*, and also the length of the pin-punch C, depend upon the thickness of the follower to be forged. It will also be seen that if the blocks are made with the form corresponding to the shape of the required follower and the holes in the proper position, followers of any shape or form can be forged by the above arrangements.

After the iron is forged or hammered to its proper size, the block B, is placed upon the anvil K, of the steam-hammer, when the iron is laid upon this block and the block A, upon the iron H, in such a way that it will match the block B. Then the pin-punch C, is inserted into the hole of the block A, and by blows upon the top *x*, of the machine, a follower is formed and punched. In order to facilitate the handling of the blocks, so as to have them always ready for operation, a spring-handle G, is fixed to the projections *a''* and *b'*, with two set screws *g g*. This handle is bent at *g'*, as shown. To maintain the blocks in a true position to each other, a stud E, is fixed into the projection *b'*, of the block B, which stud extends into a hole in the projection *a''* of the block A. This stud serves also in holding a spiral spring F, in position.

As the flanges of the upper block press against the ends of the follower in the operation, two-straps D D, are placed over the iron H, and the ends of these straps are fastened to the sides of the block B, when the spring F,

releases the flanges of the upper block from the follower. To prevent injury to the straps, grooves *a a*, are pressed in the under face of the upper block, by which means all the extra force of the blows of the hammer is brought upon the whole face of the follower. The edges of the flanges *a' a'*, of the block A, and the straps D D, are of a proper and even distance from the upper face of the block B, so that the iron will pass through freely.

After the iron is forged to its proper size it is inserted between the blocks, and the pin-punch placed in the hole of the upper block, as shown in Fig. 1, and by one or more blows of the hammer on the top *x*, of the machine, the flanges and pin-punch are driven through the iron, as is seen in Fig. 2, when the machine is partially taken off the anvil K, so as to allow the punchings *h*, and pin-punch C, to fall out, and, by inserting the iron for the next operation, the finished follower in the machine is easily removed.

The inventor prefers to use the pin-punch C, independent and disconnected from the blocks A and B, instead of having it screwed or fastened in any way to the block A, as the pin-punch being larger at its end *c*, will be free from any pressure from the follower and the follower is correspondingly easier released from the block A, having the flanges.

The object in view in constructing a machine of this kind is to form and punch articles with the power of the steam-hammer, and it differs from a common drop-press or press-punch as it is independent and disconnected from any power in its upward movement. It is especially adapted in transforming old car-axles into new car-followers, the advantages being from 400 to 1,000 per cent., varying according to the strength and skill of the hammersmith. As the iron is best formed at a red heat it is put through the machine immediately after it is forged to its proper size.

Cannan's Car-Coupling.

MATTHEW C. CANNAN, deceased, of Ulster, Pa., was the inventor of a car-coupling, letters-patent upon which have been granted to his administrator, Jesse R. Coolbaugh, of Wysox, Pa. The construction and operation of the device are shown in the accompanying cuts. Fig. 1 is a perspective view of the draw-bar and coupling devices; Fig. 2 a vertical longitudinal section, and Fig. 3 a horizontal section.

A represents the end of the car, and F B C the levers for coupling and uncoupling from the sides or top of the car. F is an elbow-lever pivoted at its elbow to an extension of the sliding box E, by a bolt G, which slides in the slot D, in the end of the car. The lower end of the lever F, is pivoted to the cross-lever B, which extends to either side of the car. The toggle-lever C, is pivoted to the cross-lever by the bolt *f*, and its lower end is pivoted upon the end of the car by the bolt *b*. E represents a sliding box, which carries the coupling-pin K, upward through the link J, to couple the cars and downward to uncouple, and is operated by the levers F B C.

L represents a metal draw-bar in one piece, having a square opening *n n*, to receive the link-follower U U, with its spiral spring V, which operates it. The opening also receives the link J, with its collar O. The draw-bar has a flaring mouth sufficient to receive links from cars of different heights and widths, and also has an opening in the opposite end for a bolt M, to screw in; also, a round opening *l*, extending from the end of the bolt M, to the square opening *n*, for the link-follower U, to operate in. J is a coupling-link with a wedge-shaped rear end resting in the socket of the link-follower U, as shown in Figs. 2 and 3, the sides of the link tapering each way from the link-collar O, and the corners being slightly rounded at each

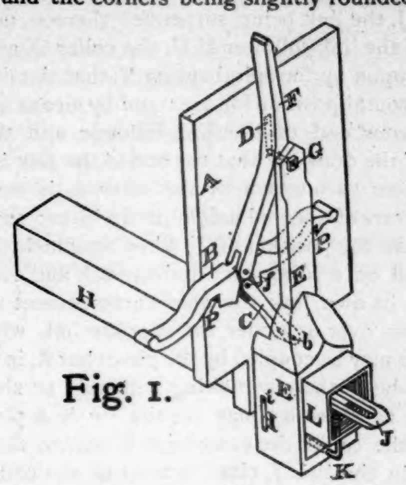


Fig. 1.

CANNAN'S CAR-COUPLING.

end. K represents an angular coupling-pin attached horizontally movable to the bottom of the sliding box E, and then passing vertically up through the draw-bar L, and it may be made of solid round metal bent at a right angle, or of bars simply joined together at the angle, which will facilitate the removal and replacing of pins in case of breakage.

H represents the elongated box in which the draw-bar L, plays back and forth, being acted upon by a spiral spring T, placed between washers N N, these washers sliding in rabbets *t t* in the rear end of the box H. The bottom of the car, together with timbers and iron plates that are used around many of the draw-bars in present use, may take the place of the box H.

Fig. 2.

Fig. 3.

CANNAN'S CAR-COUPLING.

N N are square-cornered washers operating in rabbets *t t*. T is a spiral spring between the washers N N, in the rabbets *t t*, and is for the purpose of buffer and draw-spring, by means of the bolt M, passing through the washer N, the spiral spring T, and other washer N, and then screwing into the rear end of the draw-bar L. M is a bolt that screws into the rear end of the draw-bar L, and takes the draft-strain. U U represent a link-follower with square-shaped outer end, having therein an oblong socket, in which rests the inner end of the link J. V is a spiral-

spring acting upon the link-follower for the purpose of keeping the link J, at all times in place to enter of itself and without assistance the mouth of the draw-bar L, on the opposite car. O is a square-cornered collar around the link J, near its inner end, and can be made of half-round iron or any metal of similar shape best adapted for the use it serves, the flat side being toward the link.

R is a pin running laterally through the collar O, and the link J, the link being suspended thereon, and it is by means of the link-follower U U, the collar O, and the pin R, acted upon by the spiral spring V, that the link is kept in a horizontal position for use; and by means of a socket in the outer end of the link-follower and the flaring mouth of the draw-bar that the end of the link is movable up or down to one side or the other, as is necessary in coupling cars of unequal heights and widths; and the link J, may take the position of J′, when attached to a similar draw-head on a lower car; and as each and every draw-head has its own link the above arrangement allows the link to pass over or under the opposite link, when one or both links may be coupled by the pin or bar K, in the opposite draw-head, thereby making a double or single link-coupling, as necessity may require. *r* is a pin passing through the top of the draw-head L, thence through the opening in the link J, close in front of the collar O, and then into the bottom of the draw-head L. It is the inner bearing-bolt of the link J, and aids in keeping this link suspended in place for use, as may be seen in Fig. 2, and is only moved in case of removing and replacing the link for repairs.

P P are stationary pins in the end of a box-car, upon which the lever B, rests and operates horizontally across the end of car; and B is the lever by which the operator raises or lowers the coupling-pin when standing at either side of the car. The coupling is done from the top of the car by lifting and at the same time throwing the lever F, over to the right, and uncoupling by throwing in the opposite direction. The lever B, has three shoulders or offsets on the bottom, and, as shown in Fig. 1, two of these rest against the pins P P, and these pins hold the levers when the pin K′ is dropped down to its proper place when uncoupled, and the other shoulder rests against the pin P at the right, and this pin keeps it there when the coupling-pin K, is raised to place in coupling by levers being thrown to that side; and in case it is found that this pin P, at the right is not sufficient at all times to hold the levers in place when the cars are coupled, spirals or any springs answering a like purpose may be placed under the top of the opening of the sliding box E, and directly over the draw-bar L, which will not only serve as a lock in keeping the sliding box E, up when coupled, but would assist in raising the same when operated. The levers F B C, are more especially calculated for freight-cars, yet may be used on many others, and on some cars—such as flats—where the levers F B C, and the extension on the sliding box E, are in the way, the box may be moved up and down by simply running levers from each side of the car, attaching them to the sliding box E, and pinning them to the car at a proper leverage distance from the box E, thereby doing away with the levers F B C, and the extension on the sliding box E.

This device is claimed to be simple in construction, easy of adjustment, and not liable to derangement. It is also claimed to be inexpensive and durable.

SOME months ago the JOURNAL made mention of a practical improvement in suspension-bridges, by Mr. Thomas M. Griffith. The inventor has since perfected a model some eight feet in length, in which the improvements are fully shown. This model was to have been sent to the Exposition at New Orleans, but it was not completed before the first of February and then it was decided not to send it there, and, therefore, up to the present time it has served only as a parlor ornament in the house of the builder. It is soon, however, to be placed upon exhibition. The few persons who have seen this model say that in addition to its representing, as it does, some great improvements in suspension-bridge construction, it is a very creditable piece of workmanship.

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Mansfield, Ohio, *November 3d, 1884.*

To the Westinghouse Air Brake Company, Pittsburgh, Pa.:

Gentlemen:—Understanding from your published announcements that you recommend your brake for freight-train use we respectfully invite you to a complete and searching public test of its merits in competition with the *Rote Automatic Brake*. This test to be made in so complete and critical a manner as to show all the railroads of the country, as well as the Railroad Commissioners of the various States, which of the two brakes is the one which should be used; for the test will, we are certain, leave no doubt in the minds of any witnessing it.

To insure the proper management of the test we suggest that you choose one person, we another, and these two a third person, all three to be well known as capable and honorable rolling-stock experts, to conduct the test, their expenses to be jointly borne by you and by us.

An invitation to witness the test to be extended to the General Officers of Railroads and all State Railroad Commissioners, to the members of the National Car-Builders Association, and to the Railroad and daily press.

The test to be at such time and place as may be mutually agreed upon, but we suggest that the proper place would be on some road having high grades and sharp curves, so that both brakes may have as hard and complete a test as possible. As it is necessary to make the test searching and complete, and as all railroads wish to increase the length of their trains and only wait for a brake which will enable them to do so, we think each train should be made up of 50, 60 or 70 cars, as you may prefer, or, if you think best, of even more cars.

Your company to supply your train and engines, we to supply ours.

The following points, among others, to be considered and reported upon:

Cost of equipping trains.

Simplicity.

Freedom from breakage.

Certainty of action.

Effectiveness.

Cost of maintaining.

"Flatting" of wheels.

Any other points submitted by you or by us in writing to be added to the above.

The brakes or trains are to be tested in every manner and under all conditions which practical railway service may suggest, including yard as well as line service.

Among others the following tests are to be applied to both trains:

1st.—Each train is to be (part of the time) run by engineers and crews who have never operated either brake and who are wholly unfamiliar with them.

2d.—The trains are (part of the time) to be partly made up (as nearly all freights are everywhere) of foreign cars, which have neither your nor our brake on, so that the cars having your break or ours on shall be widely and irregularly separated from each other.

3d.—The locomotives drawing your train and ours to be exchanged, from time to time, and draw each others trains.

4th.—Two locomotives equipped as so many freight engines and tenders are, with hand-brakes instead of steam or air brakes, are to be substituted for the two engines used in the test part of the time. Any brake which will not work properly if this is done, you will admit, can be of little practical value in actual service.

5th.—From time to time each train is to be stopped and foreign cars (not equipped with either your brake or ours) are to be run into it, at irregular intervals, just as actual service requires constantly.

6th.—In the making up of trains, etc., crews are to be exchanged at random, so that the test may fully illustrate the convenience of operating each kind of brake in actual ordinary service.

7th.—Frequent short runs, stops and quick starts are to be made.

8th.—A series of yard tests are to be made, showing the action, convenience, etc., of the two brakes.

We mention a few necessary tests only, and you and we, as well as the test committee, are to add any number of others, it being distinctly understood that if you decline any test proposed by us, or we decline any proposed by you, it shall be condered an explicit and positive admission of inferiority.

This rule must in every case be strictly observed, namely: *Both brakes must be tested in precisely the same manner*, so that there may not only be absolute fairness, but no room for suspicion even of anything else.

You have been in the brake field a long time, have profited justly and largely from the patronage of railroads, and we are sure will welcome this plan for allowing your patrons and the American public to judge for themselves which brake should come into universal use.

Having proper confidence in the merits of your brake we know you will gladly and promptly accept our proposition herein made, as you must feel that the test will be complete.

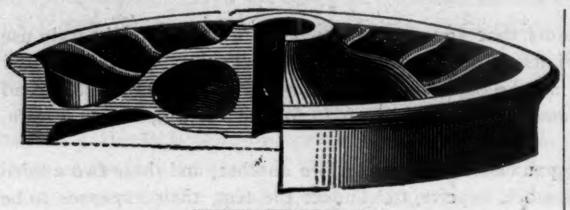
The railroad public is a very fair-minded, capable body, and will most thoroughly appreciate and fully recognize the equity and fairness of our offer to you, and, in common with business-like people everywhere, will naturally (and, we are sure you will admit, properly) consider it a virtual confession of inferiority and a public admission that the Westinghouse Brake is inferior to the Rote Brake and that it is unfitted for general freight service, should you decline or neglect to avail yourselves of the proposition we make you herein.

Permit us to add in closing that we wish to express to you our desire to have this communication received in the spirit in which it is sent, and to have it express to you our wish for a full, fair and searching test of the two articles in the relative merits of which the railroad interest is *primary* and that of the owners even secondary. Respectfully,

THE ROTE AUTOMATIC BRAKE COMPANY,

Per M. D. Harter, Presiden

Ramapo Wheel and Foundry Company.



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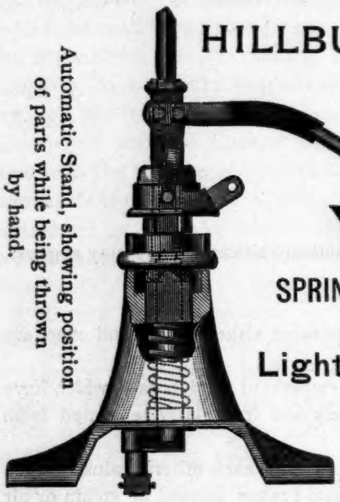

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